American Zinc, Lead & Smelting Company — August, 1938

Engineering and Mining Journal

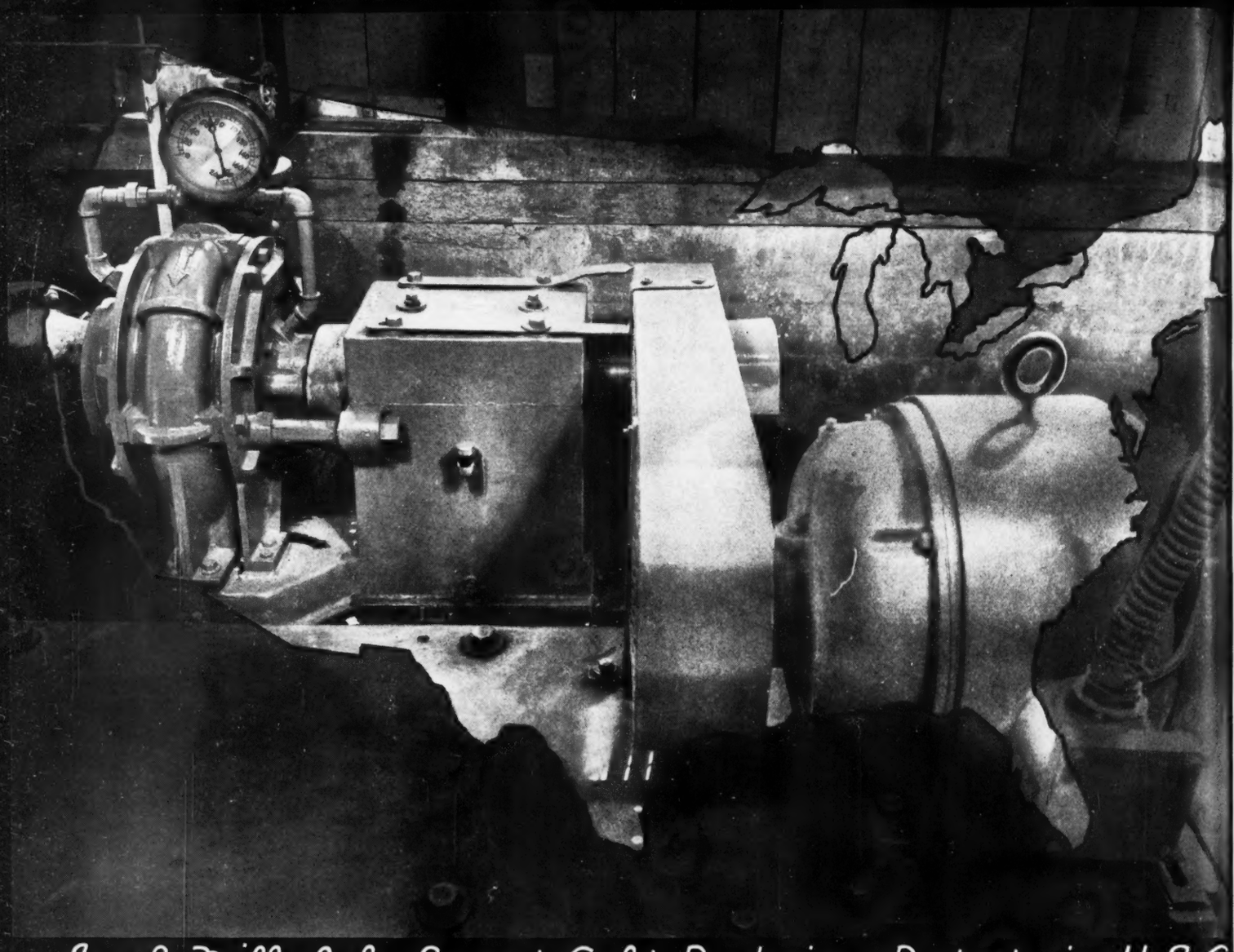
A McGRAW-HILL PUBLICATION

Price $1.00 or 4s. Per Copy

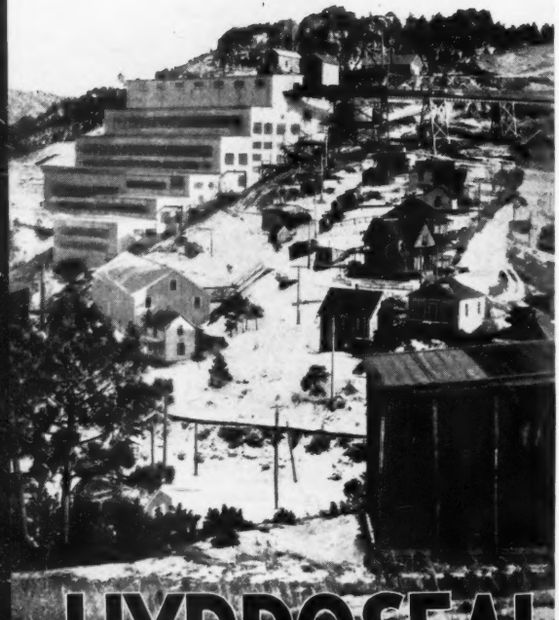
6 BEAR XANTHATES OFFER REAGENT COMBINATIONS FOR EVERY RECOVERY PROBLEM!

SEND FOR SAMPLES!

GREAT WESTERN ELECTRO-CHEMICAL CO.
BEAR BRAND PRODUCTS
SAN FRANCISCO, CALIF.



In the Mill of the Largest Gold Producing Property in U.S.A.



HOMESTAKE

MINING CO., *LEAD, SOUTH DAKOTA*

In 1937, Homestake milled 1,394,773 tons of ore. Naturally, we are proud that the Hydroseal Sand Pump (Installed May 1937) was used in this gigantic gold production, and is still giving satisfactory service. Hydroseal Pumps with Maximix Rubber Pumping Parts are saving money in practically every conceivable type of service in all kinds of mines. Your conditions would be the exception to the rule, if you, too, could not save one-third or more in power costs. In addition, Maximix Rubber generally outlasts equivalent metal parts three to six times and the parts are easily replaced in the field, when necessary. Address the nearest office listed below for a copy of our Catalog No. 937 describing Hydroseal Sand, Slurry and Dredge Pumps.

HYDROSEAL MAXIMIX RUBBER PROTECTED SAND–SLURRY–DREDGE **PUMPS**

HYDROSEAL AND MAXIMIX DESIGNS ARE COVERED BY PATENTS AND APPLICATIONS IN THE MAJOR MINING CENTERS OF THE WORLD AND CAN BE PURCHASED ONLY THROUGH THESE COMPANIES

U. S. A.: THE ALLEN-SHERMAN-HOFF CO. 239 S. 15th St. Philadelphia, Pa. Offices or Representatives in most Principal Cities. AUSTRALIA: CROSSLEY & DUFF PTY. LTD.

New York:
A. H. HUBBELL, Associate Editor
H. C. CHELLSON, W. N. P. REED
Assistant Editors
H. H. WANDERS, Market Editor

Engineering and Mining Journal

San Francisco:
J. B. HUTTL, Assistant Editor
G. J. YOUNG, Consultant

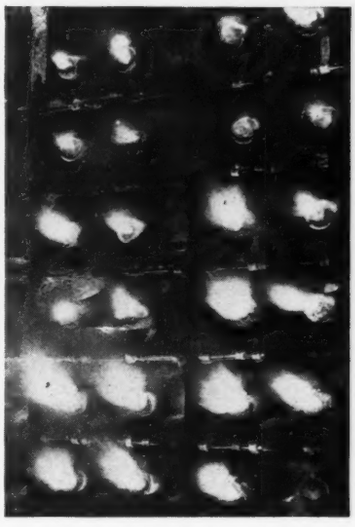
Washington, D. C.:
PAUL WOOTON

H. C. PARMELEE, Editorial Director

Volume 139 Number 8

AUGUST 1938

A Sketch of a Zinc Mining and Smelting Enterprise



PRESENTATION of the account of the varied operations of the American Zinc, Lead & Smelting Company, which is published in this issue, is by way of giving some measure of attention to a domestic resource—zinc—that grows in importance as its apparent size shrinks with the progress of consumption. Perhaps the reserve of zinc in the United States is larger than immediately appears. Experience in the case of some other commodities warns against hasty predictions of early exhaustion. Yet due respect must be given to such words of caution as those expressed by W. R. Ingalls at the meeting of the American Zinc Institute in 1937 when he said: "The time draws nearer every year when we shall be confronted with shortage in our domestic supply of zinc ore. Our old mines become exhausted. We have but few that are being held in reserve. We do not discover many new mines, although I am not unmindful of the recent developments. . . ." In the articles that follow, account is taken of the efforts of the company under review to discover new additions to its reserves of ore.

ORGANIZED just at the turn of the century, American Zinc has since had abundant opportunity to play an interesting part in the development of the industry it entered. It has not been slow to try new ideas. For example, it early made extensive use of electrostatic separation in its work. Paralleling this innovation of years ago, it is today applying differential-density separation in milling its ores at Mascot—as yet a unique procedure in dressing minerals commercially. Other instances of this progressive attitude on the part of the company will be noted in the accompanying description of its varied mining and metallurgical and related activities.

ECONOMY and efficiency are watchwords in its various departments. So far as possible at present, it is wasting nothing that it mines. If one may properly make distinction between products and byproducts, the latter include agricultural limestone, as well as stone for ballast and construction purposes, from the company's Mascot tailing; sulphuric acid, from its smelter gases; and cadmium, from dust recovered from metallurgical operations. The products comprise slab zinc, zinc oxide, and a pure zinc sulphide. The company operates, moreover, in several states, now through subsidiaries or affiliates, now directly. All in all, the summary given will be found instructive.

Thirty-eight Years Of Growth

Through subsidiaries and directly, the American Zinc, Lead & Smelting Company conducts an extensive business, with operations in several states

Milford Riggs, Jr.
Assistant Secretary
American Zinc, Lead & Smelting Company
St. Louis, Mo.

▶ ZINC WAS MINED AND SMELTED *as such at Franklin furnace and Sterling Hill, in Sussex County, N. J., in 1850. Mining and utilization of zinc ore began in the upper Mississippi Valley in 1860.*

The mining of zinc, however, has gone hand in hand for the most part with the development of lead mining. It is said that lead was mined in Wisconsin in the seventeenth century, but some doubt has been cast on this report. The first official records indicate that lead was first mined in the Mississippi Valley in Missouri in 1700 by the French, who were searching for silver. They made their way up the Meramec River north of Ste. Genevieve, established mines, and manufactured lead in the Mine la Motte and Potosi section.

Lead was discovered in the southwestern part of Missouri in 1848, but up until 1854 only a small tonnage of lead had been mined. From that latter date on, the development of lead mining in the southwestern part of Missouri grew rapidly.

The first zinc smelter in the Mississippi Valley was that of the Matthiessen & Hegeler Zinc Company at La Salle, Ill., in 1860. In Missouri the first metallic zinc was manufactured at Potosi by G. Hesselmeyer in 1867. A zinc smelter was built and operated at Carondelet in 1869. By 1875 there were being operated in the Mississippi Valley 1,688 retorts, which produced 4,650 tons of spelter.

Two zinc smelters were operated in the gas fields of Kansas by 1880, and a zinc smelter was operated at Rich Hill and West Joplin, Mo., in 1881. In 1882 three zinc smelters were operated in Illinois, one smelter was in operation at Collinsville, one at Peru, and one at La Salle; five smelters were operating in Kansas, four of which were at Pittsburg, and one smelter was running at Weir City; five smelters were in operation in Missouri; three at Carondelet, the one at West Joplin, and the one at Rich Hill.

During the early operations in the Joplin district, the zinc ore, which was called "jack," was put out upon the dumps as waste material, as it was of no interest to the lead miners. The Wisconsin field had been the principal source of zinc ore supply for the smelters in the upper Mississippi Valley, but with the establishment of smelters in the Kansas natural-gas field, and the consequent increased demand for zinc ore, the importance of the Joplin field as a source of zinc ore increased.

Zinc and lead were found in Arkansas, Oklahoma, and Kansas, and this district gradually became known as the Tri-State district.

THE American Zinc, Lead & Smelting Company was organized in 1899, coming into existence at a time when zinc was fast becoming an important factor and the company would have an important part in the growth of zinc mining and smelting as one of the country's prominent industries. Although the company was organized primarily for mining and smelting both zinc and lead ores, its activities have been in the zinc field for the most part. During the 38 years of its existence it has witnessed the many ups and downs that go with the development of a commodity of little interest to one of wide and important use.

The company was organized by W. H. Coolidge, Edward A. Clark, and others in Boston, who had faith in the development of lead and zinc mining.

Early mining operations by the company were carried on in the Carterville-Oronogo camps, near Joplin, Mo. Most of the mining in this locality had been done by shallow mining methods, but on the American company's Davey tract the first deep shaft in the district was put down, and a large concentrator was built. This property was operated from 1902 to 1919 with six shafts and four mills.

In 1903 American Zinc acquired a smelter at La Harpe, Kan., in the gas field. This plant was operated only a short time and sold. Two other smelters were purchased in 1906; these were at Dearing and Caney, Kan. They were operated until after the World War. Ore for them came from Wisconsin and the West, as well as from the Tri-State district, during the World War, to meet the heavy demand for metal.

In 1913 a zinc smelter and sulphuric acid plant were placed in operation at Hillsboro, in the Illinois coal district. The location of a plant in this area was to meet the necessity of finding a more dependable source of fuel supply, as the existing gas wells in Kansas at that time were becoming depleted. The plant at Hillsboro consisted of five blocks with 4,000 retorts, two Hegeler roasting kilns, and a chamber acid plant with a capacity of 30,000 tons of acid per year. Two oxide furnaces were built later at this plant and the capacity of the retort furnace was increased.

During the period in which the Wisconsin district was a substantial producer of zinc and lead, American Zinc became interested in that field, and in 1908 organized, as a subsidiary, the Wisconsin Zinc Company. The latter acquired property in the southern part of the Wisconsin field, and mined a substantial tonnage of zinc and lead, most of which went to smelters of American Zinc. The Wisconsin operations were discontinued around 1930 after the demand for zinc had become such that the operations there could not be conducted at a profit.

Zinc was found in Tennessee at about the same time that zinc mining in southwestern Missouri was being de-

veloped, but it was not until 1910 that American Zinc became interested in zinc mining there. The No. 1 Mascot orebody was developed in 1913, and a concentrator of 1,000 tons per day capacity was erected. Adjoining tracts of land were acquired, and in 1914 the No. 2 shaft was sunk, and this mine was placed in operation in 1915. A 600-ton mill was built on the Roseberry property just west of Mascot No. 1. This property was purchased from the Grasselli Chemical Company in 1916, and was operated until 1918. Later, the capacity of the concentrator at No. 1 was increased to 2,400 tons per day, and flotation was also adopted. It was at this plant that the use of copper sulphate was developed in the flotation of zinc ores. The type of ore mined is a lead-free zinc sulphide.

In 1927 American Zinc acquired a lease on the Jarnagin property, near Jefferson City, Tenn. This adjoins the company's Mossy Creek property, purchased in 1916.

In 1916 American Zinc acquired the properties of the Granby Mining & Smelting Company, which consisted of a large acreage of mineral lands in the Granby and Joplin field of the Tri-State district, a lead smelter and custom concentrator at Granby, Mo., and a coal-fired smelter near East St. Louis, along with certain coal rights in Illinois. This acquisition also included a zinc smelter at Neodesha, Kan., which was operated until shortly after the World War. The zinc-smelting operations at Hillsboro, Ill., were discontinued in 1924, and since that time the smelting of zinc has been carried on at the East St. Louis plant.

A zinc oxide plant as erected at Columbus, Ohio, and placed in operation in 1920. This plant obtains its ore from the Mascot mine, making from it a high-grade lead-free zinc oxide. The American process with Weatherill grates is used entirely at Columbus.

The scope of the operations of the American Zinc, Lead & Smelting Company can best be shown by listing the various subsidiaries and those companies in which the American Zinc, Lead & Smelting Company has a substantial stock ownership.

The parent American Zinc, Lead & Smelting Company operates its Missouri and Kansas holdings and also its various Western properties.

The American Zinc Company of Oklahoma operates in Oklahoma, where a small amount of mining and milling has been done.

Operations in Arkansas are carried on by the American Zinc Company of Arkansas.

Tennessee properties are operated by American Zinc Company of Tennessee.

American Zinc Company of Illinois operates the oxide smelter at Hillsboro, Ill., and the zinc smelter at East St. Louis, Ill. This subsidiary company also owns various coal rights in the Pocahontas field in Illinois.

HOWARD I. YOUNG
President, American Zinc, Lead & Smelting Company

The American Limestone Company sells the various classes of limestone products produced from the Mascot mine and quarries in Tennessee.

The American Zinc Sales Company sells and distributes the various commodities of the parent and subsidiary companies other than the limestone products.

Other companies owned by American Zinc, Lead & Smelting Company, or in which it has a stock ownership, are: Appalachian Limestone Company, Watauga Stone Company, Metaline Mining & Leasing Company, Wisconsin Zinc Company, and the Silver Dyke Mining Company. The Wisconsin and Silver Dyke companies are now being liquidated.

Products of American Zinc and their sources are as follows:

Zinc and lead concentrates produced in Tennessee and the Tri-State district and by the Metaline Mining & Leasing Company in Washington.

Limestone of various sizes for ballast, fertilizer, and construction purposes.

Roasted zinc ore, slab zinc, sulphuric acid, and metallic cadmium produced at the East St. Louis, Ill., plant.

Leaded zinc oxides of various grades produced at the Hillsboro, Ill., plant.

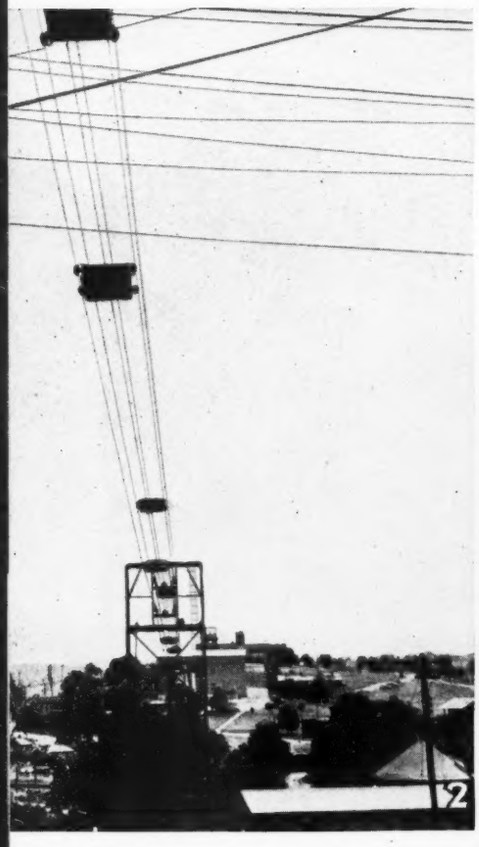
Lead-free zinc oxide produced at the Columbus, Ohio, plant.

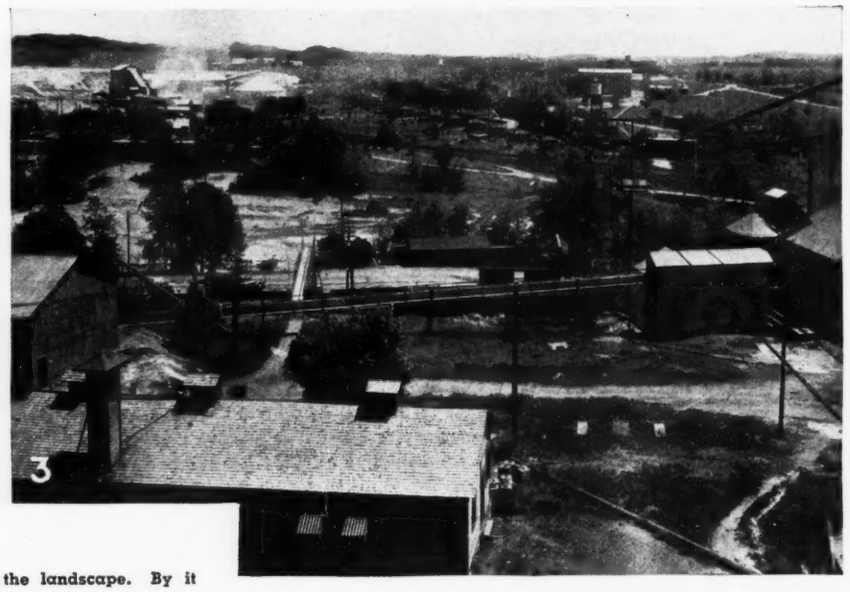
The company has not been unaware of the necessity of considerable research work. During the past few years it has built and is now operating at Mascot a commercially successful plant using the differential density process of ore separation. At Columbus, Ohio, it has developed a process for making zinc sulphide pigment. Patents also have been obtained for unique uses of dolomitic limestone.

1 Introduction to Mascot. The zinc concentrator, seen through the arch of the railway bridge. Here all Tennessee ores of the company are milled, to the extent of 2,500 tons per day

AMERICAN ZINC'S EXTENSIVE OPERATIONS

A SUMMARY

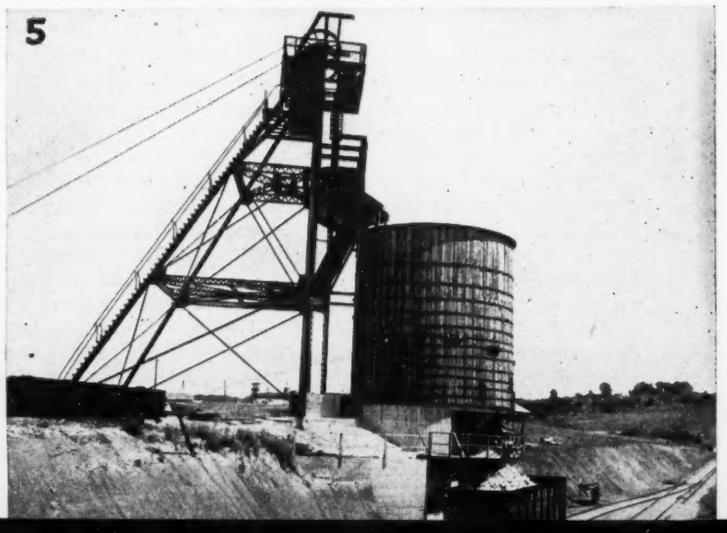


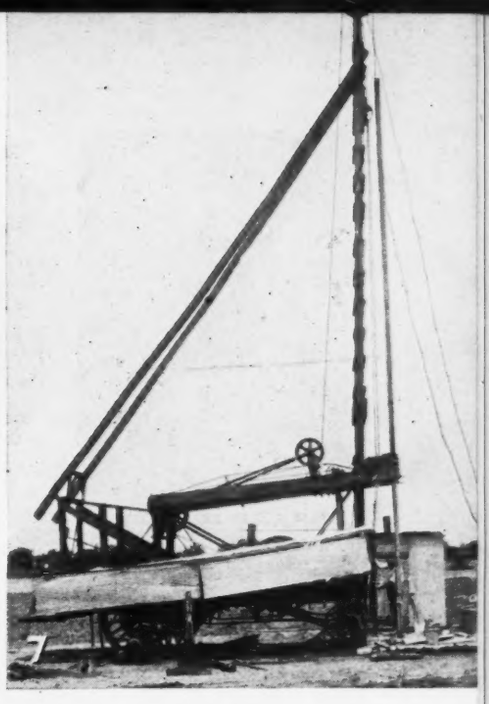


2 The wire-rope tramway at Mascot dominates the landscape. By it the ore from No. 2 mine, after being crushed, is brought to the mill for concentration. Cres from the other mines are received by railway

3 Looking over Mascot from the tramway terminal at the concentrator. In the distance, at the end of the tramway, are the shaft and crushing plant at No. 2 mine, and beyond these is the Mascot school. At the left, in the distance, is the limestone plant

4 The limestone plant at Mascot which produces agricultural limestone from the concentrator tailings. To the right on the sky line is the concentrator and crushing plant No. 1. At the extreme left are seen the shaft and crushing plant at No. 2 mine

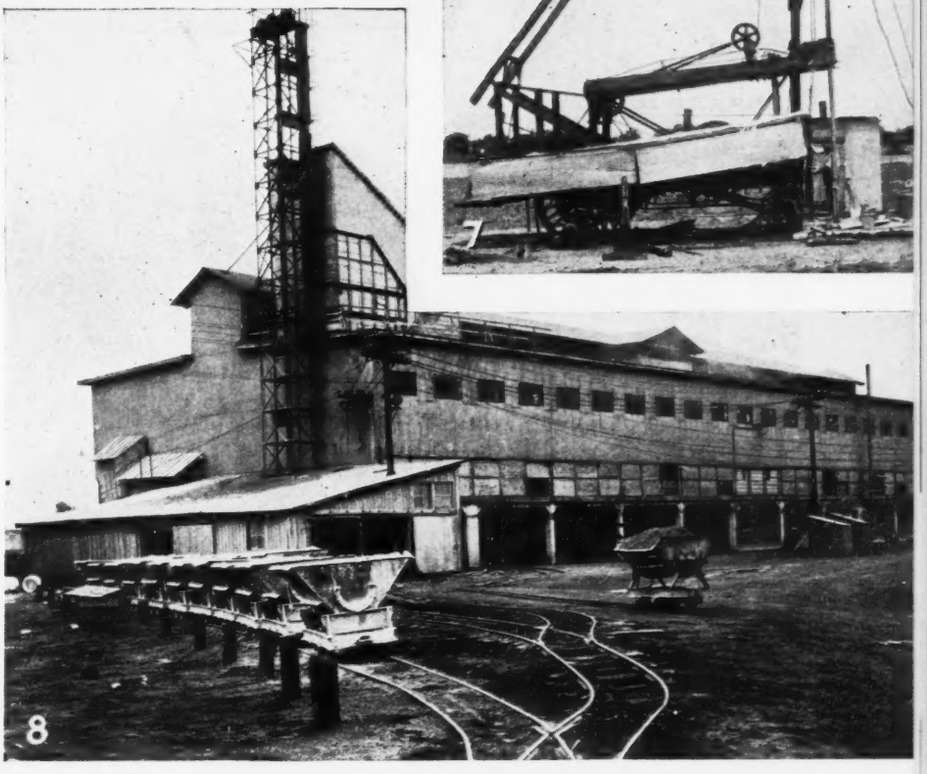




5 No. 2 shaft at the New Market mine, at New Market, Tenn. This is equipped with balanced skips for hoisting ore. Cars are loaded at the bin and shipped over the Southern Railway to the mill at Mascot, 12 miles to the west

6 At Hillsboro, Ill., is one of the two zinc oxide plants of the company. This plant, operated by the subsidiary American Zinc Company of Illinois, makes leaded zinc oxide by the direct, or American, process from calcined concentrates supplied by the smelter at East St. Louis

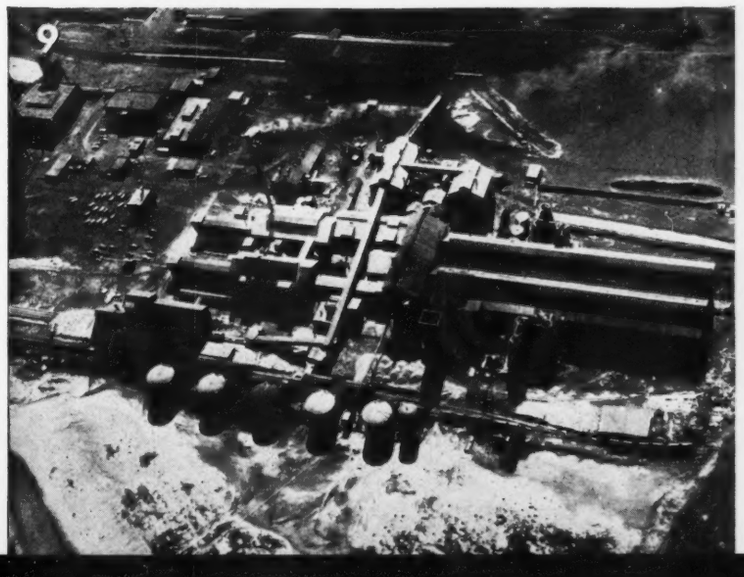
7 In the Tri-State district. A drill of the American Zinc, Lead & Smelting Company is here employed in exploration work in the Kansas field near the company's Robinson mine

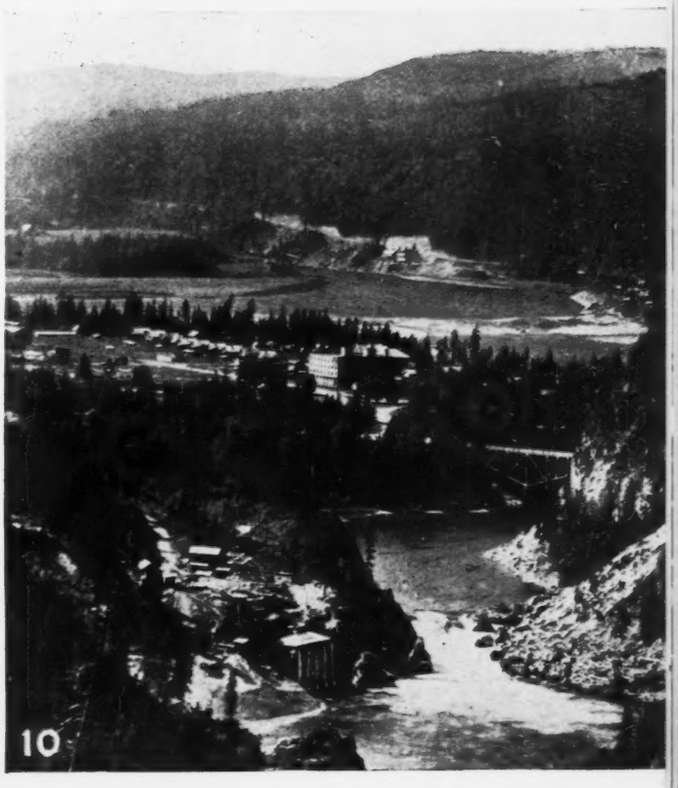


8 The zinc oxide plant at Columbus, Ohio, here seen, is operated by the subsidiary American Zinc Oxide Company. It produces a lead-free zinc oxide by the direct process from Mascot concentrates, which contain very little lead. These are roasted at the plant

9 The Granby smelter, otherwise known as the East St. Louis plant, of the subsidiary American Zinc Company of Illinois is one mile from East St. Louis, Ill. It produces slab zinc, zinc anodes, sulphuric acid and metallic cadmium. Part of it is seen here

10 In Pend Oreille County, Washington, are the zinc-lead properties of the Metaline Mining & Leasing Company, controlled by American Zinc. An extensive drilling and development campaign has been under way. The company's buildings may be seen in the center background at the foot of the wooded slope





Staff Members of American Zinc

MILFORD RIGGS, JR.

contributing to this number

MARK H. NEWMAN

HARLEY A. COY

ROBERT AMMON

T. B. STANSEL

P. M. ARTHUR

G. W. JOHNSON

N. L. ALLEN

A. C. EIDE

M. K. EASLEY

D. I. HAYES

TENNESSEE OPERATIONS

Zinc Ores of East Tennessee

Occur as Replacements in Dolomite

Production largely sulphides, in both brecciated and recrystallized types—Areas worked lie within the Great Valley

Mark H. Newman
Chief Geologist
American Zinc, Lead & Smelting Company
Mascot, Tenn.

► THE PRESENCE OF ZINC *in East Tennessee has been known probably for a hundred years or more. It appears that the first zinc-ore production from the State started shortly before the Civil War at the Mossy Creek mine, near Jefferson City, in Jefferson County. This was followed in order by production from the Lead Mine Bend property, in Union County; the Straight Creek mine, in Claiborne County; and the New Market mines, near New Market, in Jefferson County.*

Mining at Mascot, in Knox County, probably started at some time early in the period mentioned in the foregoing. Early mining at first was from outcrop, and early production was of oxidized ore. Of the mines mentioned, New Market, Jefferson City, and Mascot are the only localities now active, and in each of these places the production is sulphide, with additional output of oxidized ore in the Jefferson City district.

During the period between 1890 and 1910 several small-scale attempts were made to mine and to concentrate the sulphide ores in the locality of Mascot, but it was not until 1913, when the American Zinc Company of Tennessee became active there, that this district became really important as a source of production. During that same year the Embree Iron Mines, a group of old iron mines near Embreeville, in Washington County, began the production of oxidized ores. These two properties, Mascot and Embreeville, have operated practically continuously since. Later the Davis and Maples mines of the Universal Exploration Company, one a sulphide operation and the other producing oxidized ores, were started at Jefferson City, and still later, in 1929, the Jarnagin mine, in the Jefferson City district, a sulphide mine near the now inactive Mossy Creek mine, was started by the American Zinc Company of Tennessee. In 1937 another sulphide mine, situated near New Market, also in Jefferson County, was put into operation by the American Zinc Company of Tennessee.

PRESENT PRODUCTION of zinc sulphide ores of East Tennessee originates in a 20-to 25-mile-long segment of one of the several secondary valleys that make up the Great Valley of East Tennessee, and in which are located the subdistricts of Mascot, New Market, and Jefferson City. This district is situated northeast of Knoxville, which lies in the same secondary valley. A large aggregate production of oxidized zinc ores has been made over the past 25 years from a group of mines at Embreeville, which is situated about 80 miles northeast of Knoxville, and an earlier production both of oxidized and sulphide ores, of both zinc and lead, was made at Lead Mine Bend, about 25 miles northwest of Knoxville.

Each of these districts falls within the Great Valley of East Tennessee. The complex folding and the enormous thrust faulting characteristic of the Southern Appalachian region are present here. The topography, which consists of parallel secondary valleys and intervening ridges, is accountable to this underlying structure. Each of the localities mentioned, with the exception of Embreeville (which is in the Shady limestone, an older formation), is underlain by Knox dolomite. The Lead Mine Bend area occurs near the bottom of the Knox, and the present district of sulphide production, or the Mascot-New Market-Jefferson City district, occupies a horizon approximately 2,000 ft. stratigraphically above the bottom of the Knox. Zinc showings are common in outcrop in most of the valleys that form this part of the Great Valley.

The structure of the ore-bearing part of the Knox, in the Mascot-Jefferson City area, in general is monoclinal, with varying dips to the south or to the southeast. Ores of this district are associated with the Jefferson City formation, a subdivision of the Knox, approximately 300 ft. thick. The Knox was involved in the regional mountain-making movements of the Southern Appalachians. The result was wide-scale breaking, faulting, and metamorphism within that formation.

Within the Jefferson City formation the results of these earth movements appear as areas of brecciation and metamorphism, with which faulting is associated in varying degrees. The Jefferson City formation, particularly in its lower part, is made up of hard, brittle dolomites and interbedded limestones. Apparently, under pressure the dolomite beds tended

to shatter to form breccias in the extreme case, while the limestones tended to flow to form the type of rock known locally under the name "recrystalline," which may be described as a marbleized, dolomitized, and in places, rather highly silicified rock. Sulphide ores are associated with both breccias and recrystalline. The distribution of both, and particularly of the breccias, though widespread throughout the district, apparently is quite irregular. Neither, by any means, is universally zinc bearing. The interstices of the breccias are found to have been almost completely filled by secondary dolomite, or by dolomite and sphalerite. The white of the secondary or gangue dolomite frequently stands out in startling contrast to the grays and blacks of the fragments of rock dolomite. The amount of dolomite so introduced has been enormous. Healing has been practically complete, however, vugs and openings, other than late cracks or solution openings, being rare.

At Mascot usually both types of ore, breccia and recrystalline, are present in any orebody. There is a marked tendency on the part of the crystalline ores to be more prevalent near the bottom of an individual orebody, with the breccia ores above. This relation is due to the original relative position of the two types of rocks before crushing and alteration.

The bottoms of the Mascot orebodies usually fall on some one, but not always the same, bed of altered limestone, or recrystalline, in the upper or middle part of the series of interbedded limestones and dolomites. The bottom may follow such an individual bed for long or for short distances. This zone has a thickness of perhaps 150 ft. or more. Breccias and recrystallines occur in the lower part of this zone, and likewise below the zone. The upper breccias and recrystallines frequently are zinc bearing. This is the ore-bearing horizon, whereas the lower breccias and recrystallines seldom, if ever, are zinc bearing. This relation has not been explained. Possibly it is due to vagaries of circulating water, by which that circulating above the relative impervious brown limestones and recrystallines carried zinc salts, and that below was without zinc; or perhaps it may be due to a completion of the healing of the breccia voids and to the recrystallizing of brown beds in the lower part of the zone before zinc-bearing solutions came along and before the upper breccias had been completely healed and the limestones completely recrystallized.

As the orebodies occupy places in this general stratigraphic horizon, their dips follow the structure. Dips in the mines at Mascot will average perhaps 20 deg., whereas, dips in the Jefferson City and New Market mines are less steep.

Tennessee Mines Yield 3,500 Tons Daily

This output of zinc ore from Mascot, New Market, and Jefferson City areas— Workings are shallow, with open stopes

H. A. Coy
Mine Superintendent
American Zinc Company of Tennessee
Mascot, Tenn.

THE concentrating plant of the American Zinc Company of Tennessee is at Mascot, Tenn. The ores supplied to it originate at mines at Mascot, New Market, and Jefferson City, all in the same State.

Crude ore from the New Market mine, which is situated 12 miles east of Mascot, with a daily production of 900 tons, and from the Jarnagin mine, which is 16 miles east of Mascot at Jefferson City, with a daily production of 600 tons, is transported to Mascot by the Southern Railway. Ore from these two mines is crushed and screened at Mascot in one crushing plant. The ore from No. 2 mine, at Mascot, the only mine now producing there, is prepared for milling in a second crushing plant located at the collar of the hoisting shaft. This mine produces 2,000 tons of crude a day.

The mine at each property was developed by vertical shafts located at points in barren ground best suited for operation.

Two shafts serve the New Market

Tops and sides and bottoms of orebodies throughout the mined areas are irregular. The tops and bottoms fall at various beds or horizons. Brecciation and shattering usually become less as tops and sides of orebodies are approached. There is no true hanging wall nor footwall, the sides, top, and bottom of an individual orebody being reached when, or where, by the decreasing mineral content, the ores are judged to be no longer commercial. Therefore, here an orebody may be said to have commercial boundaries. Such edges, except the bottoms, usually, but not always, are marked by disappearance of brecciation and by decrease in shattering, the bottom usually being marked merely by a sharp lowering of values. In some parts of the Mascot mines, infrequently the cut-off of the ore may be sharp along local fault lines or along bedding planes, but in general it is likely to be marked by a fading of values.

The Mascot orebodies are large, and follow long, sinuous and winding courses. Possibly they will average between 125 and 150 ft. in width in case of the larger orebodies. Vertical thicknesses will vary from perhaps 10 ft. to 100 ft. or more in extreme cases. When such great thicknesses occur, both breccia and recrystalline ores are present. The orebodies are remarkably continuous, and it has been found almost without exception, upon evidence of mining and prospecting, that all the known deposits interconnect.

Developments at Mascot have reached depths of approximately 800 ft., and prospecting has demonstrated the presence of commercial ore down to about 1,000 ft., or approximately sea level. Speaking generally, no pronounced changes in degree of brecciation, or of zinc content of the ore, or in mineral association, have been noted at these depths.

The ore mineral itself is a light yellow sphalerite. The gangue includes country rock, dolomite and recrystalline, both of which commonly are cherty to varying degrees; gangue dolomite, and some, but not much, pyrite. Igneous rocks are not known to exist in the vicinity of the mines.

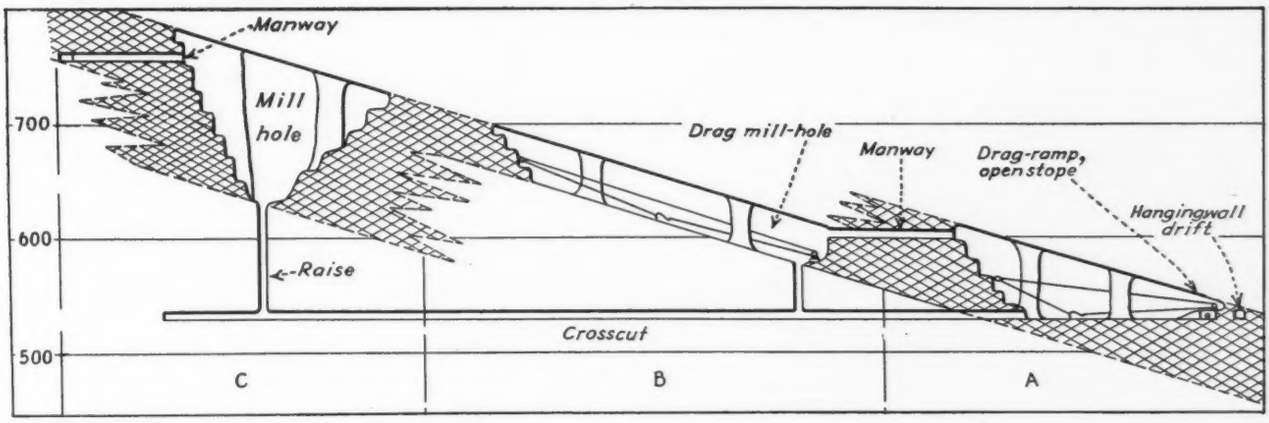


Fig. 1 . . . Mining by open stopes at Mascot—three typical cases are shown, the section being parallel with the dip in each. *A*, An open stope is being mined from a hanging-wall drift, with loading by scraper over a timber ramp. *B*, Stoping in an underground glory hole (or mill hole) is supplemented by scraping after the ore has ceased to run into the raise by gravity. *C*, Ore broken in the underground glory hole is delivered to the raise by gravity

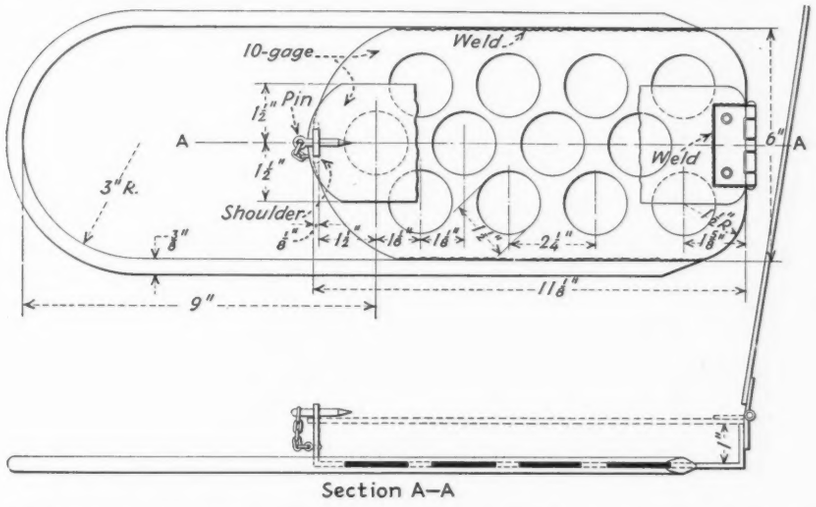


Fig. 2 . . . Since 1934, detachable bits have been standard at the company's mines in Tennessee. Each drill man has two bit carriers, such as this, which are numbered, one in service, while the other is in the shop for refilling

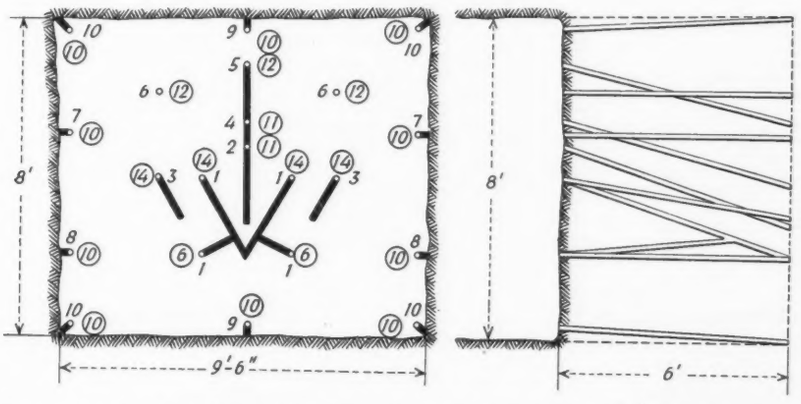


Fig. 4 . . . The "wedge-cut" drift round, shown here, is also used in the mines in Tennessee. See also Fig. 3

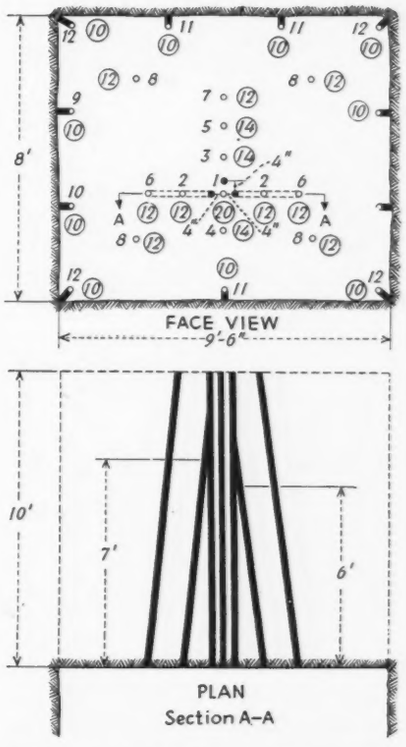


Fig. 3 . . . This drift round, locally known as the "burn-out," is used with that shown in Fig. 4 in the company's Tennessee properties. The choice depends upon the ground

mine. No. 1 is a two-compartment shaft, 366 ft. deep, and is equipped with a cage for handling men, supplies, and waste rock. No. 2 shaft is used for ore hoisting and ventilation, and is about a thousand feet west of No. 1 shaft. No. 2 is a three-compartment shaft, 420 ft. deep, and is equipped with two skips operated in balance.

The Jarnagin mine is served by a single, three-compartment shaft 300 ft. deep. Ore is hoisted in 1¼-ton cars on cages in balance.

Exploration—Both diamond and churn drills formerly were employed in prospecting on American Zinc properties in the district, but in recent years most prospecting has been done by churn drill.

Due to the irregular trends and outlines of the orebodies, considerable preliminary and irregularly spaced drilling is customary. In preliminary blocking-out drilling, a 200-ft. spacing commonly is used, which is followed by such intermediate drilling as may seem needed.

The rock formation is tight and remarkably free of openings, and, therefore, affords good sample recoveries. Customarily, grab samples are taken of drill cuttings at 5-ft. intervals when in barren rock. Samples for assaying are taken at 3-ft. intervals when a hole is in ore. The entire

Holston Creek, which flows directly over the workings of No. 1 mine at Mascot, has long had a concreted bed throughout this portion of its length, to keep the water from flooding the mine, as happened years ago. Overhead is the tramway running from No. 2 crushing plant to the concentrator

bailings from the 3 ft. run are settled and taken to the sampling department, to be prepared for the laboratory. No other sampling is done at the drill.

A small portion of the cuttings from each run, both in barren and in ore ground, is treated with dilute hydrochloric acid to digest the carbonates. The resultant insoluble residues are examined under a binocular microscope for characteristics that aid in the identification and correlation of significant horizons—a study which has reduced the under- and over-drilling of holes.

Underground prospecting at Mascot commonly is by driving strike drifts in the hanging wall for diamond-drill sites. Such drifts frequently have value later as haulage drifts. A large proportion of such other development drifts and crosscuts as may be driven are also used later as locations for diamond drilling. Grab samples are taken after each round in such developments when in ore.

Considerable diamond drilling is done in stopes. The ordinary type of rock drill frequently is used in working places for drilling short test holes, the cuttings from which are assayed or not, as may be deemed desirable. Underground diamond-drill holes seldom exceed 125 ft. in depth. Most, but not all, diamond-drill holes are drilled vertically, either up or down. The core is logged, and the entire ore-bearing core is sampled and assayed. Core recovery for the most part is satisfactory. No attempt is made to recover sludge from underground diamond drilling.

Stoping—As used in this district the term "mill hole" is applied to an underground glory hole. Mill-hole ore delivers through raises and chutes into cars. When the ore of a mill hole, because of flattening bottom, ceases to deliver by gravity to its raise, drags are installed and the mill hole is then known locally as a "drag mill hole." Open stopes are started from points where haulageways intersect orebodies. Ore from stopes is loaded either by hand shoveling or by drag ramp loader.

Mining in both mill holes and open stopes is by the "heading and bench" method. Pillars usually are about 25 ft. in diameter, and normally headings between pillars are carried about 40 ft. wide. Pillar spacing varies, however, with the physical condition of the roof and of the working place. No timbering is required. A heading is 7 ft. high and is cut immediately below the bed chosen for the roof. Its face is kept in "rail-fence" shape to give maximum tonnage broken per foot drilled. The ore below such a heading is cut in benches or terraces down to the bottom of the ore.

In normal practice two headings advance simultaneously in each working place. Two miners, one in each heading, constitute a drilling crew. Drilling is done on the day shift. Each miner's equipment consists of a $2\frac{3}{4}$-in. diameter air drill with sliding cone shell mounted on a 3-in. diameter 6-ft. column. This drill dismounted is used for drilling vertical bench holes. Air pressure at the drill is 80 lb. Several small air receivers are placed at various points in the mine to remove water from the air.

Drill men lay their own pipe line, do their own blasting, and transport supplies and equipment to and from the working place. They are responsible for the safe condition of their working place.

Drilling—Prior to 1935, bits were forged on drill steel. Following a testing of various types of detachable bits, the "Jackbit" was adopted as standard at all properties. Comparative costs between the two indicate that the change to detachable bits has effected a material saving in air consumption and in drill repairs, as well as an increase in feet drilled per machine-shift.

For stoping and drifting at Mascot, $1\frac{1}{4}$-in. hollow round lugged steel is used, whereas $1\frac{1}{8}$-in. hollow round steel is standard at New Market and at Jarnagin mine. In drilling in raises, 1-in. hollow hexagon steel is used. In blockhole drilling at chutes and in stopes, $\frac{7}{8}$-in. hexagon steel is used. Threads for detachable bits are forged on all drill rods in the steel sharpener, and are chased with threading dies. Shank and thread ends are re-dressed on a shank grinder. Miners are required to bring all drill rods to the underground shop periodically for re-servicing.

Starting bits for stope drilling are $2\frac{1}{8}$-in. gage, with $\frac{1}{8}$-in. drop in gage in series to $1\frac{5}{8}$- in. All bits are returned to the underground shop at the end of each drilling shift for regrinding, retempering, or upsetting. Regrinding of a bit is practicable until its original chilled surface has been worn through. Retempering then is necessary. This usually, but not always, follows the third grinding. When gage wear occurs with no great loss in stock, bits are upset on the steel sharpener and then reground and tempered.

Each drill man has two numbered bit carriers (Fig. 2), in which he carries his bits to and from the blacksmith shop. One contains sharpened bits for the day's drilling; the other contains the bits used on his previous shift and is left in the shop for refilling. Blacksmith-shop equipment consists of a steel sharpener, an oil-fired furnace, tempering vats, and shank and bit grinders.

Blasting—Ammonia dynamites are used in stope shooting at all properties. Some 30 per cent gelatin dynamite is used in certain types of developments. All explosives are packed in 50-lb. cases, except the ammonia dynamites used at Mascot, which are supplied in 25-lb. cases. Explosives are delivered from surface magazines to the mines twice weekly, and are distributed in special cars to magazines on each level.

A locked box for explosives is maintained at each working place. These boxes are divided into three compartments, the center compartment being filled with sawdust. Fuse and caps are stored in one end compartment and explosives in the other.

Miners sign a requisition at the beginning of the shift for their day's supply of explosives, which later in the shift is delivered in a special car to the locked boxes at their working

places. Canvas bags are used in transporting explosives from such boxes to points in the working place where they are to be used. The New Market and Jarnagin mines are wet, and, therefore, detonators are prepared on surface. A special cutter and crimper is used, and all detonators are waterproofed by dipping in a special sealing compound. At Mascot, the miners make up their own detonator at the working place. The drill cuttings that accumulate at the collar of vertical holes are used in stemming. All blasting is done at the end of the day shift. Miners receive their shooting signal by flash code over the floodlights, such signals being controlled by a switch situated at the underground mine office.

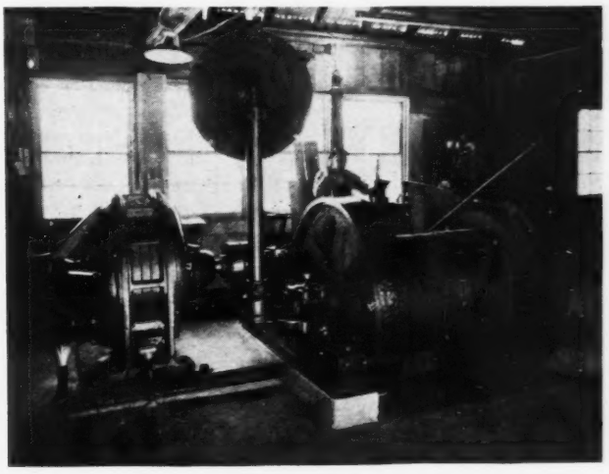
Drifts, Raises, and Inclines—Haulage drifts at the Mascot and Jarnagin mines are 8x8 ft. in cross-section. Inclined haulageways at all mines and level haulageways at New Market are driven with 9x9-ft. cross-section. Two types of drift rounds are used at these properties, "burn-out" and "wedge cut." Figs. 3 and 4 illustrate these types and show the location of holes, the number of cartridges used, and the order of firing.

A drift crew usually consists of two drill men. An average advance of 6 ft. is made in each 8-hour working shift. Two piston drills 3½ in. diameter, each mounted on a separate column, are standard equipment in such developments.

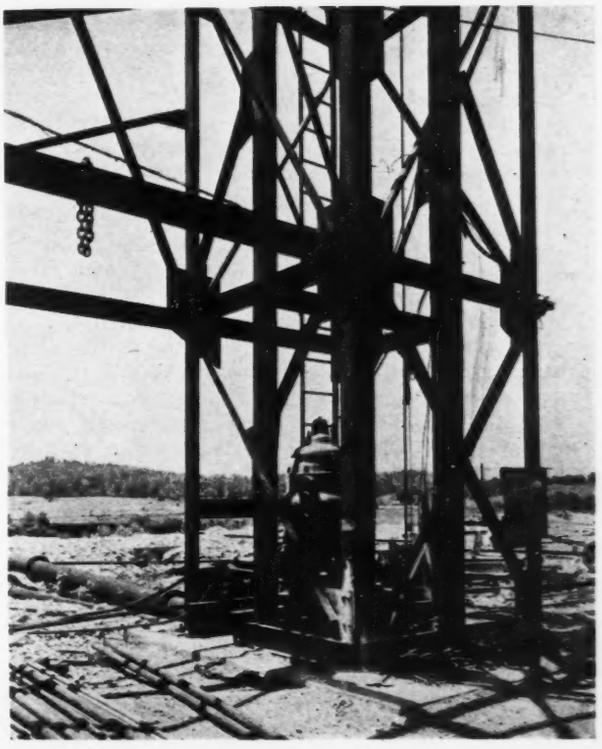
Raises are driven 5x5 ft. in cross-section. A heading usually averages 5 ft. in depth. For raise drilling a self-rotating, wet stoper drill is used. All raises to be used for delivering ore into cars from mill-hole mining are reamed to about 10 ft. in diameter. Dragged ore can be delivered through a 5x5-ft. raise.

Loading—Loading includes hand shoveling, chute loading, and slushing or drag loading. Hand shoveling is used in short development drifts and in the opening up of new working places preparatory to the installation of dragging equipment. Slushing or dragging may be said to be of two types, depending on the delivery point of the ore. In the one case the ore is delivered into raises, from which it is drawn off through chutes into cars on haulage levels, and in the second case it is dragged directly into cars over non-portable ramps on haulage levels. Electrically driven drag hoists of 15 to 50 hp. are used. Both drag hoe plates and arms are of cast manganese steel. Cable used is 9/16 in. in diameter, 6x19 plow

Open stope on No. 5 level of Mascot No. 2 mine. The orebodies are replacements of the Knox dolomite. In the Mascot-New Market-Jefferson City area the ore horizon is approximately 2,000 ft. stratigraphically above the bottom of this formation



At the New Market mine (above right). This hoist serves the 366-ft. No. 1 shaft, which is equipped with a cage for handling men, supplies, and waste rock. Ore is hoisted in No. 2 shaft 1,000 ft. away



This deep-well turbine pump, 1,000-g.p.m. capacity, was installed last year in No. 1 shaft at the New Market mine. It delivers about 300,000 gal. to surface each 24 hours. The sump holds 50,000 gal. This shaft also has two centrifugal pumps, as standbys, of a combined capacity of 1,500 g.p.m.

steel, with independent wire-rope center.

Transportation—Trolley locomotives of 4- and 6-ton design, powered by 250-volt d.c., double-unit motors, are used on main level haulage at Mascot and at New Market. Trolley wire at these two mines is of the figure-eight type. It is supported by insulated hangers, spaced 10 ft. apart on tangents and closer on curves. Trolley wires are guarded. On long hauls, a feeder cable parallels the trolley wire, and is tied into it at intervals.

Tracks at all mines are of 24-in. gage, and are laid with 40-lb. rails. Track grades are one-half of 1 per cent in favor of the loads. Minimum curve radius is 50 ft. The tracks at the Mascot mine originally were bonded by flexible bonds with mechanical connections. As new track is laid, or as track replacements are required, however, mechanical connections are being replaced by electrically welded connections. All track at New Market is electrically bonded.

Laybys of sufficient length to hold a trip of cars are provided at chutes in main haulageways. At chutes and ramps in secondary haulageways laybys are not used. Empty cars are spotted above a loading point. After loading they are dropped down by gravity to the nearest point convenient to locomotive. Track grades for this type of tramming average about 1 per cent. Mules are used to some extent in gathering.

At the Mascot mine, cars are of 40-cu.ft. capacity, and are equipped with railway-type journal boxes with 14-in. wheels. They are of box type and are so built of extra-heavy steel as to withstand the heavy duty incident to chute and drag ramp loading of rough and heavy ore. Steel-incased oak bumper blocks and hook-type couplings with spring-cushioned drawbars are used. Cars used at the New Market mine for transporting ore are of 80-cu.ft. capacity and of the Granby side-dump type. One-ton end-dump cars are used in development work. Waste rock from development work is hoisted in the cars, and is disposed of on the surface. This mine has a 400-ton skip pocket equipped for the dumping of cars of the Granby type. At Jarnagin mine, which is in process of development, all cars are hand trammed. These cars are of 1-ton capacity. Three parallel tracks at the shaft provide a flexible switching arrangement for the loading and unloading of cars on and off the cages.

The tipple at Mascot is electrically driven. It is of rotary type, and dumps two cars at a time. It may be stopped in any position to facilitate the cleaning of cars. The ore delivers from the tipple into a 750-ton skip pocket, and is drawn off into 4-ton skips through air-operated, finger-type chutes.

At Mascot, main-line locomotives deliver loaded cars to a yard near the skip pocket. Loads from stopes below the main haulage level are hoisted to that level over three inclines. In one incline the cars are delivered directly into the yard by the incline hoist. All loads are put through the tipple by a 4-ton locomotive used exclusively for that purpose.

Wages and Contracts—Drilling, dragging, and loading for both mining and development are contracted. Other underground work is paid for on an hourly basis. The irregular shape of the orebodies in respect to width and thickness does not lend itself to standardization of contract rates. Hence, the rate per ton varies in each working place according to its physical condition.

Breaking on Contract

At Mascot the crew of a working place usually consists of machine men and drag men. One of the machine men is the leader or head contractor of this group. A rate per ton is agreed on between the management and the head contractor. The rate includes cost of labor of the stope crew and the cost of explosives. Equipment is furnished by the company. The net earning of the group is the contracted cost of the tonnage it produces, from which the cost of its explosives has been deducted. This earning is divided among the crew according to the hours worked and the classification of each man. At the Jarnagin mine and at the New Market mine, stope contracts are let and earnings are divided on a like plan, except that explosives are furnished by the company and the rates involve wages only. Loading at chutes and shovel loading in open stopes are contracted on a tonnage basis. Inasmuch as this type of work does not vary greatly, rates are standard, irrespective of the loading point. Drilling, blasting, and loading in drifts and raises are contracted on the basis of a lineal foot of advance.

Ventilation and Lighting—Ventilation at Mascot is a simple problem. A 45,000-cu.ft. fan at the collar of No. 4 shaft, which is situated at the extreme east end of the mine, and an injector blower over a churn-drill hole at its extreme west side, supply all artificial ventilation required.

The intake and outlet of the fan at No. 4 shaft are so arranged that by opening one door on the intake side and by closing a door on the outlet side the mine's ventilation may be reversed.

At New Market, a 10,000-cu.ft. fan on the main haulage level at No. 2 shaft makes an upcast of that shaft and a downcast of No. 1 shaft. This provides good ventilation throughout the mine.

Ventilation at the Jarnagin mine is provided by a fan on surface over a churn-drill hole. Circulation underground is augmented by compressed air through injector blowers placed in drifts and crosscuts.

The mines are electrically lighted. Floodlights are installed in all working places. Workmen furnish their own lamps and the company supplies carbide.

Mine Drainage—Mine drainage at all properties is through open ditches along haulageways. The main pumping station at the Mascot mine is located at the skip loading level. All water is pumped directly to the surface (585 ft.) by a two-stage, centrifugal pump of 3,000-g.p.m. capacity. An abandoned mill-hole working, near the shaft, forms the main sump. Its capacity is about twenty-five million gallons. In this sump the water clarifies before reaching the pump. Two 1,000-gal. standby centrifugal pumps are located on the main level. These may be put into service should the water in the sump rise to a certain point. All water from the lower workings is relayed to the main level and to the main sump by electrically driven pumps, whose combined capacity is approximately 4,000 g.p.m. The total amount of water pumped to the surface from the mine averages about 1,150,000 gal. per day of 24 hours.

At the New Market mine, a deep-well type pump installation, situated at No. 1 shaft, delivers about 300,000 gal. to the surface each 24 hours from a sump with 50,000 gal. capacity. On the main level at this sump are situated two standby centrifugal pumps, electrically driven, with a combined capacity of 1,500 g.p.m. The pump installation at the Jarnagin mine is identical to that at the New Market mine. The pumping plant at this mine is protected against heavy or sudden inflows by a bulkhead by which the pumps and the shaft station may be sealed off at will from the rest of the mine. The amount of water pumped at each of these three mines, and particularly at Mascot and Jarnagin, is to a considerable extent seasonal. During periods of heavy or continuous rainfall it increases, and during dry spells it decreases.

It is the customary practice to install bulkheads in drifts entering ground where there appears to be reason to expect water trouble or where the water situation is unknown. Such bulkheads are of steel and concrete, and are so constructed that they may be closed readily in the event of unexpected inrushes of water.

Mascot mine ore feeding into the 30-in. gyratory in No. 2 crushing plant

Milling at Mascot

Practice includes preliminary "differential density" separation, jigging, tabling, and flotation. Present daily tonnage, 2,500

R. Ammon
Chief Metallurgist

T. B. Stansel
Research Chemist

American Zinc, Lead & Smelting Company
St. Louis, Mo.

PRESENT milling practice at Mascot consists of dry crushing the Mascot ore to 1¼ in. and the Jefferson County ores to ½ in., differential density treatment, jigging, fine grinding, and flotation.

Data on the jigging and flotation processes are given in detail in two former articles on "Mascot Milling," one by Robert Ammon in Vol. LXXI, *Transactions* of the A.I.M.E., 1925, and another by C. B. Strachan, published as Information Circular No. 6379, November, 1930, by the United States Bureau of Mines.

The present article deals primarily with changes necessitated by increased tonnage and new milling developments.

All of the ore from the Mascot mine (approximately 2,000 tons per 24 hours), after a preliminary removal of the minus-½-in. material, is now treated by a recently developed differential density process. From this operation a concentrate and a tailing are derived. The concentrate is delivered to the regular milling department for further treatment, and the tailing joins the jig mill tails for delivery to the crushed-stone department. Metallurgical data on this differential density operation for the month of March, 1938, show the results given in the table on page 52.

The Jefferson County ores are handled through a new crushing plant, which was put into operation in 1937. In this unit the ore from these mines is reduced to ½ in., and delivered directly to the jig mill. The amount of ore from all sources sent to the mill totals 2,500 tons per 24 hours. This tonnage varies, of course, with concentrate demand. In January, 1938, it reached a peak of 3,932 tons per 24 hours. Present typical assays and recovery are as follows:

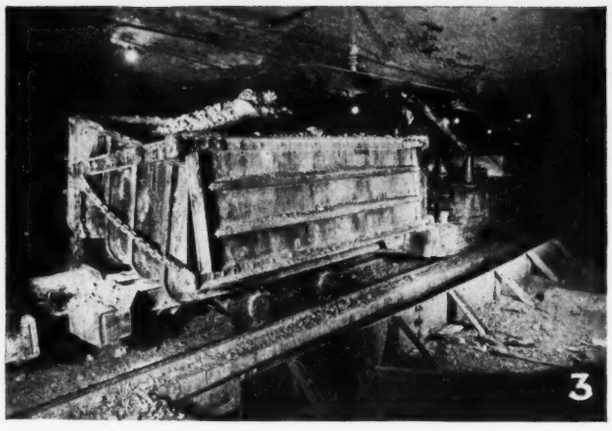
Heads—Mascot, 2.75 per cent zinc; Jefferson County, 3.50. Total coarse tails (combination product from jig mill and differential density unit), 0.50 per cent zinc. Flotation feed, 3.82 per cent zinc; flotation tails, 0.10; jig concentrates, 60.50; and flotation concentrates, 63.10. Extraction is 90 per cent.

Coarse-Crushing Plants—The Mascot mine is served by a crushing plant consisting of a 30-in. McCulley gyratory, operating in open circuit, receiving ore direct from a small surge bin at the top of the mine shaft, and reducing the run-of-mine rock to 3½ in. A 4-ft. Symons cone crusher, operating in open circuit, receives the gyratory discharge and reduces it to 1¾ in. Following this is a set of 54-in. Garfield rolls operating in closed circuit with a 5x14-ft. Niagara screen with 1¼-in. square-hole openings. This 1¼-in. material is conveyed to a small storage bin, which serves the loading station of the automatic aërial tramway for transportation to the concentrating plant.

Ore from the Jefferson County mines is delivered in railroad cars to a track bin of two cars' capacity. From this receiving bin the mine-run material is fed by a Ross chain feeder onto a 48-in. belt conveyor, which delivers it to a 26-in. Traylor gyratory, operating in open circuit, where it is reduced to a 3-in. product. This 3-in. material is conveyed to a 4-ft. Symons cone crusher operating in open circuit and delivering a 1½-in. product. Final reduction is accomplished in a set of 54-in. Garfield rolls, operating in closed circuit with two 4x10-ft. Allis-Chalmers screens with ½-in. round-hole openings. The undersize from this operation is conveyed to a 2,000-ton fine-ore bin, which serves the jig mill.

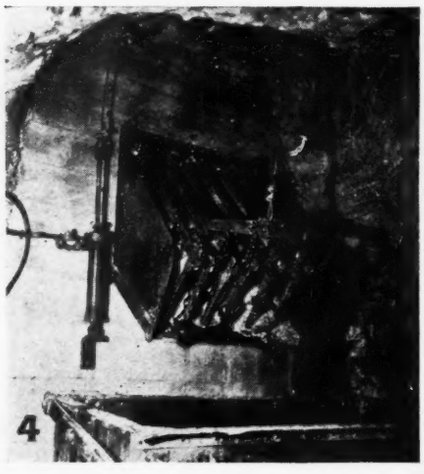
In the screening operation just described, which is separating material primarily for jigging purposes, round-hole screens are used in order to reduce to a minimum the quantity of flats in the jig feed. Experience has also shown that with the round-hole screen there is less blinding than with the square-hole type when used in this operation. This new crushing unit, when reducing mine-run material to ½-in. size, has a capacity of 110 tons per hour.

Weighing and Sampling—Sampling of products throughout the mill, with the exception of jig concentrates, is accomplished by means of automatic equipment. The Geary-Jennings samplers have now replaced all those of the old type, which were actuated by compressed air. Jig concentrates are sampled from the bins with a pipe sampler. Shipment samples are ob-



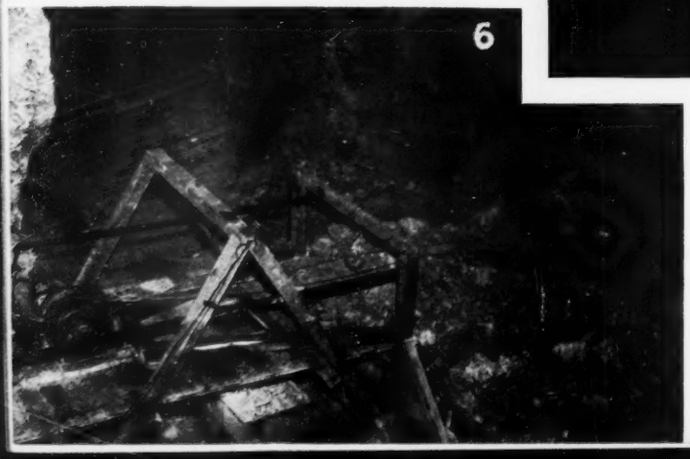
AT THE TENNESSEE PROPERTIES

UNDERGROUND AND IN THE MILL



4 Air-controlled chutes, built of steel and concrete with a gate of steel fingers, used at New Market mine in loading "mill-hole" ore and "drag mill-hole" ore

5 Pillars in the open stopes on No. 1 level in Mascot No. 2 mine



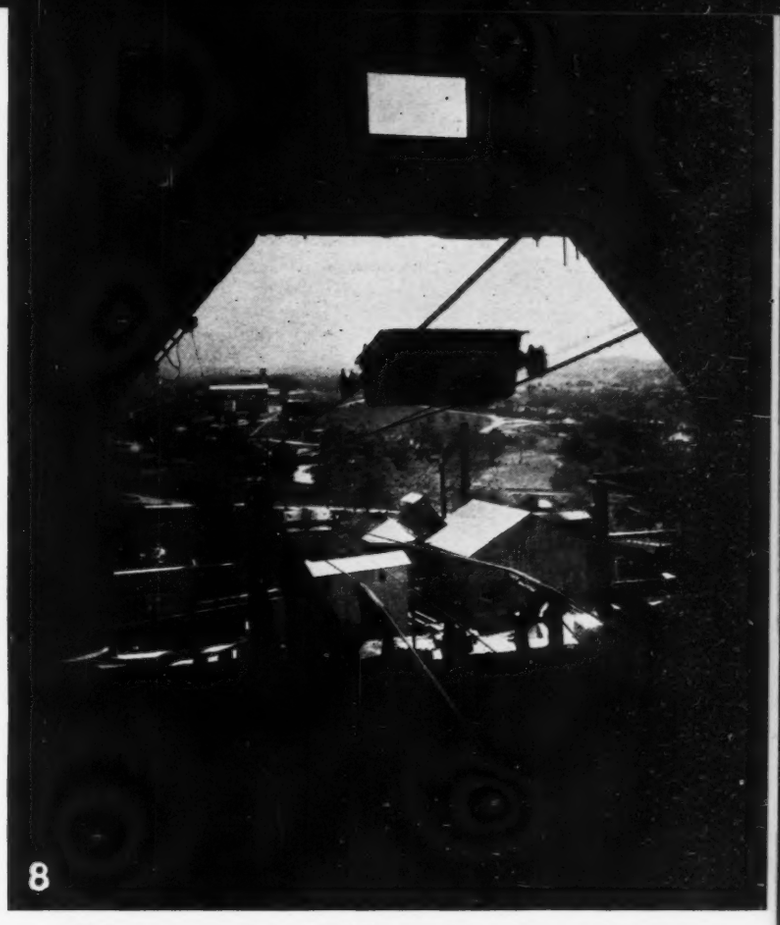
6 The timber ramp and hoist platform employed in loading cars directly on the haulage level with a scraper, or drag, from an open stope

1 Drilling in the Mascot mine, as in the others, is done on day shift. Normally two faces are advanced simultaneously in each working place. Two men, one in each heading, constitute the drilling crew

2 Scraping to a chute in the New Market mine. Electric double-drum hoists are used in the three mines, the horsepower ranging from 15 to 50

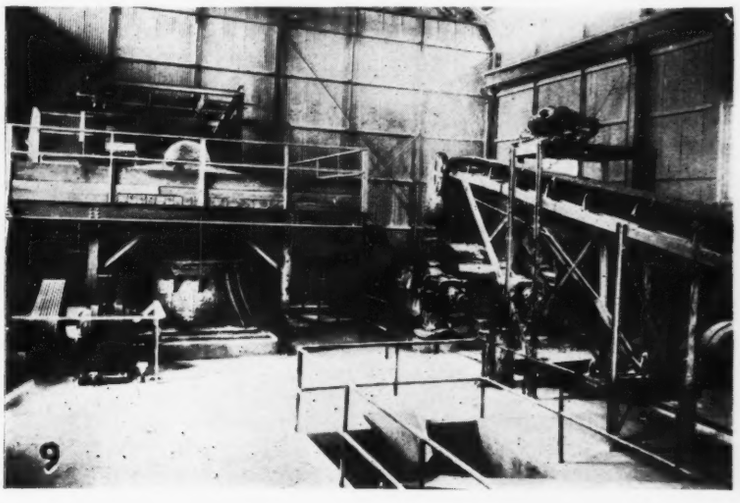
3 Dumping ore in the New Market mine. The Granby-type car is of 80 cu.ft., or 4 tons', capacity. Waste rock from development work is hoisted in the cars to surface, where the pocket is equipped for dumping cars of this type

7 A close-up view of the cutter of the Vezin sampler



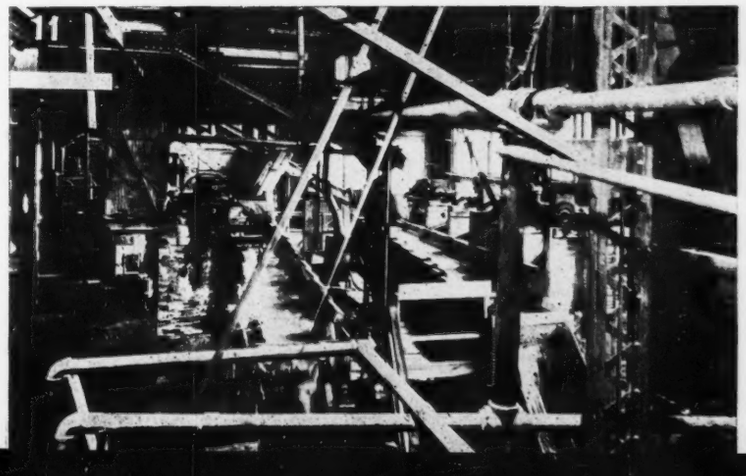
8 A tramway bucket, of 1,800-lb. capacity, arriving at the concentrator from the crushing plant at Mascot No. 2 mine, seen in the distance

9 In No. 1 crushing plant at Mascot built last year to handle the ores from the two mines in Jefferson County. The ore is here reduced to ½-in. size and delivered to the jig mill bin

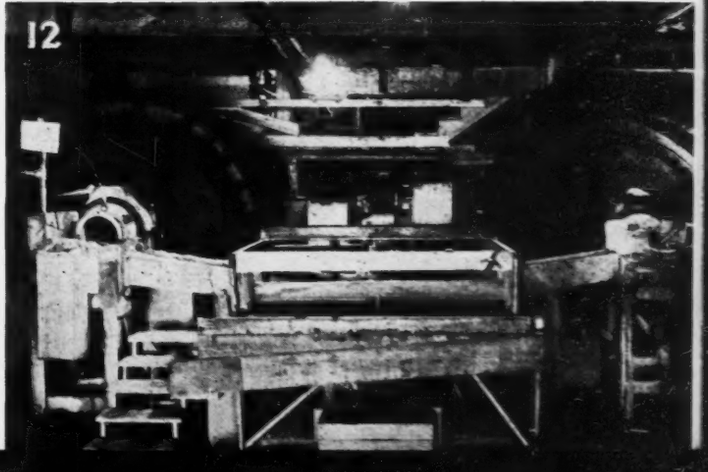


10 This four-cell Sub-A Fahrenwald-type machine was installed last year in the flotation plant at Mascot to replace three old-type Janney cleaners

11 The rougher section of the jig mill. In this plant, marked improvements have been made in the mechanical equipment and in material-handling methods, giving simplicity, efficiency, and economy



12 Ball mills and rake classifier in the jigging plant at Mascot



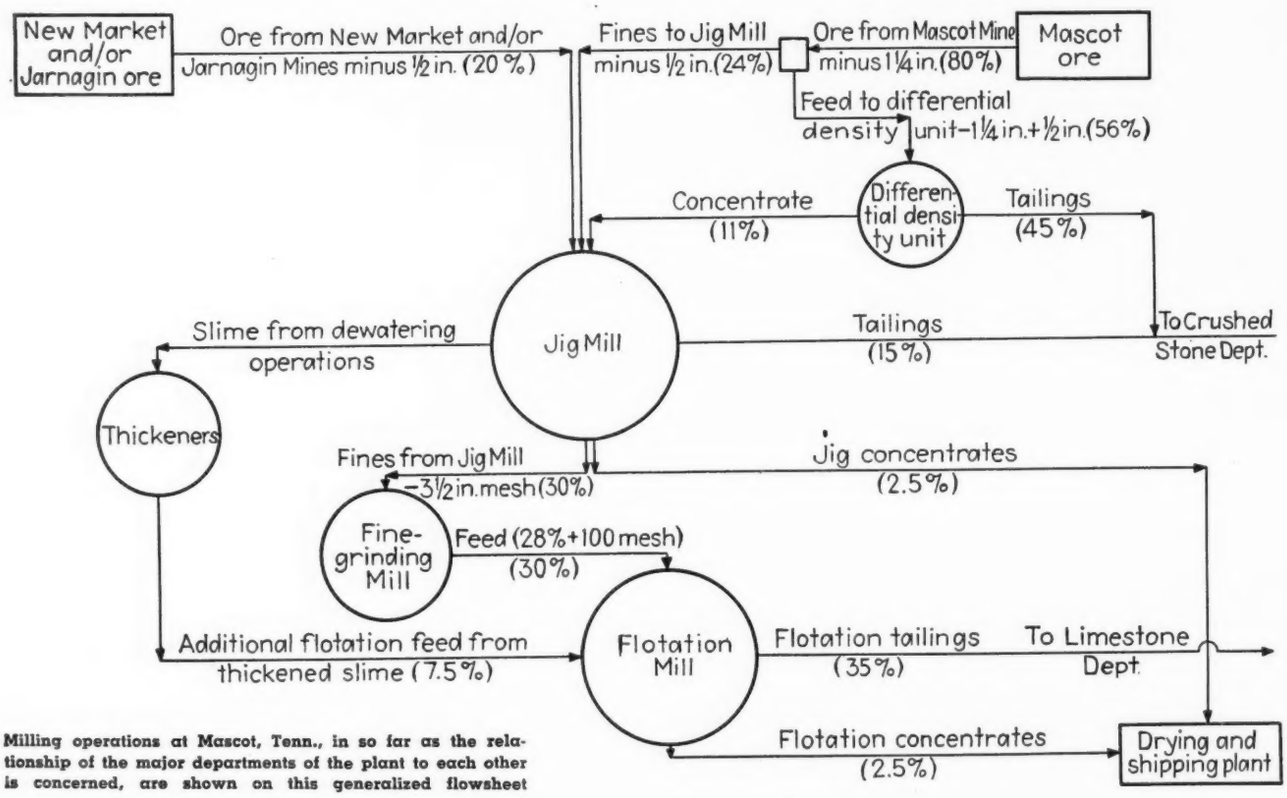
tained from the cars with a horn sampler.

Particular improvement has been made in weighing and sampling mill heads from the various sources. The tonnage of ore handled from the Jefferson County mines is derived from the weight delivered in railroad cars after correction for moisture content. Each railroad car is weighed before and after dumping. Moisture is determined on a sample taken after conveyor belt and the final sample portion collected in cans for moisture determination and zinc assay.

The 1¼-in. sized ore from the Mascot mine, after being delivered by the aërial tramway to a small bin at the head end of the concentrator, is first passed by gravity through a Schaffer Poidometer (30 in. by 4 ft.) for recording the weight. This ore is then sampled in a manner similar to the operation described in the foregoing for Jefferson County ores, with the following differences: The first cut removes 2½ per cent of the total. This portion goes onto a 4x10-ft. Allis-Chalmers screen with ⅜-in. square openings, which is operating in closed circuit with an Allis-Chalmers Pulverator (Size No. 1). From the undersize produced in this operation another cut is taken, removing 1 per cent of the original total. This final cut is collected in cans for moisture and zinc determinations.

The final cuts from the two ore-sampling operations herein just described go through further cutting-down and size-reduction processes in the preparation of a sample of laboratory size. The excess is returned to the milling system. Before being assayed for zinc content, all laboratory samples are reduced to minus-100-mesh fineness.

Aërial Tramway—All ore from the crushing plant at the Mascot mine shaft is transported to the concentrating plant by a completely automatic aërial tramway. This installation was made in 1927, replacing an old-type aërial tramway, which required twelve men for its operation over a three-shift period. This automatic installation was furnished by the Interstate Equipment Corporation, of New York. It is 1,817 ft. long and is equipped with 26 buckets of 1-ton capacity and operated at a speed of 400 ft. per minute. At present, with the buckets carrying a 1,700-lb. load, it is delivering ore at the rate of 110 tons per hour.

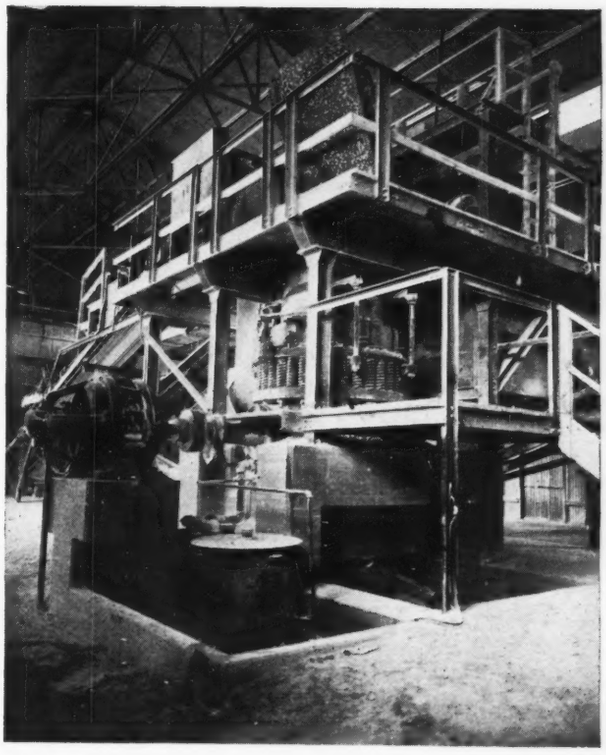

New Market and/or Jarnagin ore
Ore from New Market and/or Jarnagin Mines minus ½ in. (20%)
Fines to Jig Mill minus ½ in. (24%)
Ore from Mascot Mine minus 1¼ in. (80%)
Mascot ore
Feed to differential density unit-1¼ in.+½ in. (56%)
Differential density unit
Concentrate (11%)
Tailings (45%)
Jig Mill
Slime from dewatering operations
Tailings (15%)
To Crushed Stone Dept.
Thickeners
Fines from Jig Mill -3½ in. mesh (30%)
Jig concentrates (2.5%)
Fine-grinding Mill
Feed (28%+100 mesh) (30%)
Additional flotation feed from thickened slime (7.5%)
Flotation Mill
Flotation tailings (35%)
To Limestone Dept.
Flotation concentrates (2.5%)
Drying and shipping plant

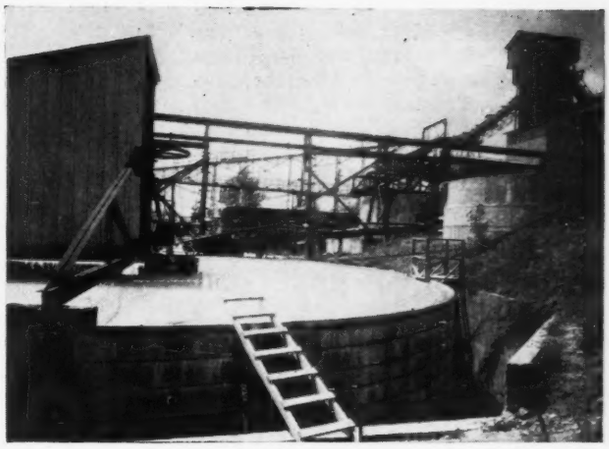
Milling operations at Mascot, Tenn., in so far as the relationship of the major departments of the plant to each other is concerned, are shown on this generalized flowsheet

Data on Operation of Differential Density Plant, March, 1938

	Solids			Zinc			
Product	Tons	% Total	% Orig.	Assay %	Tons	% Total	% Orig.
Concentrates	1,857	9.79	7.30	15.30	284.0985	80.32	39.09
Tails	17,117	90.21	67.32	0.407	69.5982	19.68	9.58
Feed	18,974	100.00	74.62	1.864	353.6967	100.00	48.67
Fines	6,452	.....	25.38	5.781	373.0123	.....	51.33
Totals	25,426		100.00	2.858	726.7090		100.00

Ratio of concentration, 10.22
Tons per hour, 58.61

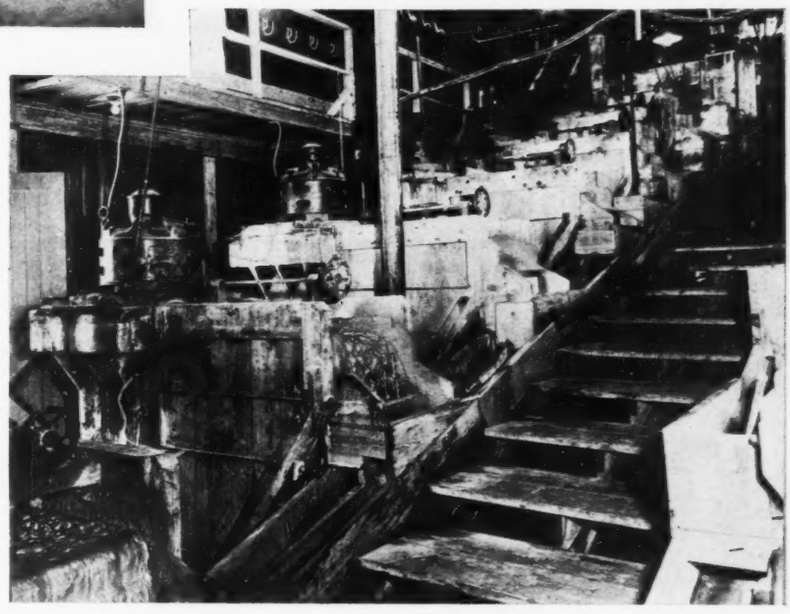




Thickeners at the Mascot mill

The secondary cone crusher in the new No. 1 crushing plant at Mascot. It is driven by a 100-hp. motor

In the flotation department of the Mascot mill. A battery of Janney-type machines



Some improvements have been made on this installation which have resulted in increased efficiency and lower cost. One of these was the replacing of the continuous haulage cable by a cable made up in 140-ft. sections with link connections to the several buckets. This feature enables a cable failure at some point along the line to be corrected by inserting an easily connected spare section, rather than necessitating the installation of a total length of cable. Another change was the provision of the ore buckets with manganese-steel wheels fitted with easily lubricated Timken roller bearings. The originally provided wheels and bearings were inadequate to support the weight of material handled. Wheel breakage and lubrication troubles were frequent occurrences. These troubles have been eliminated with the equipment now in use. Also, in experimenting with track cables it was found that the expensive high-carbon steel cables originally provided could be satisfactorily replaced by a cheaper soft-steel cable which was furnished by the American Cable Company. This softer cable has ample strength, is less brittle, and gives longer service.

Jigging Department—Jigging practice has remained the same as previously described. However, marked improvements have been made in mechanical equipment and in material-handling methods, which have resulted in simplicity, efficiency, and economy.

It has been the policy in this department to eliminate so far as possible all cup elevators, and this has been done to the extent that at present only two of these remain in operation. One is at the head of the plant delivering mill feed, and one handles chats in the regrinding circuit. The discarded elevators have been replaced with Wilfley pumps, belt conveyors, or drag belt conveyors (with provision for slime overflow) according to suitability for the operation involved. The jigging department, in combination with the differential-density unit, is now producing 50 per cent of the total concentrate tonnage, and rejecting as a coarse tailing 55 to 60 per cent of the total original tonnage delivered from the mines.

Fine Grinding—Special improvement has been made in this department. It has been found that by exercising constant control over the dilution in the fine-grinding circuit so as to maintain a pulp discharge from the mills of about 70 per cent solids, one ball mill could be dispensed with entirely, and a classifier discharge obtained of suitable fineness for flotation purposes (approximately 28 per cent plus 100 mesh), and at a 1-1 dilution, which could be handled directly by the flotation plant without further treatment. Thus a larger tonnage is now being treated by this department with a smaller number of mills, and relief has been given to an overloaded thickener system, which heretofore was forced to handle the classifier discharge to prepare it for the flotation plant.

The feed to the fine-grinding circuit as delivered from the jig mill is all minus 3½ mesh, and this material is

divided between a 7x10-ft. rod mill and a 7x12-ft. ball mill. These two mills operate in closed circuit with one Dorr FX classifier, the classifier overflow passing by gravity to the mill pump station, from which point it is delivered directly to the flotation machines. This Dorr FX classifier was installed in 1937, replacing an old-type Model D Dorr machine. As compared to the old unit, the FX classifier is sturdier in construction, capable of handling a larger tonnage, and also can be operated with a greater circulating load, which is an advantage in connection with the control of solids going into the mills.

The fine-grinding department is also responsible for the handling of all fines that are collected from the different dewatering operations throughout the mill. These overflows are all collected in the Dorr thickener system, and the thickened pulp from this source furnishes from 20 to 25 per cent of the flotation feed, and the clear-water overflow furnishes a little over half of the jig-mill water supply. This total water requirement is about 4,500 g.p.m.

Flotation Department — Flotation practice is substantially the same as has been previously described. Considerable improvement has been made, however, in the concentrate-cleaning operation. In 1937 one four-cell (cells 43x50 in.) Denver Equipment Company "Sub-A" Fahrenwald-type machine was installed to replace three old-type Janney cleaners. On this new machine one cell is used to deliver a finished product, the cleaner tails from all cells being returned to the middling circuit. These cleaner tails show a present value of about 15 per cent zinc, compared to 20 to 25 per cent zinc from the old type of cleaner.

Due to a different type of aëration and agitation in the Denver "Sub-A" machine, it is possible to handle successfully a cleaner and a more heavily loaded froth, and this unit easily takes care of the increased flotation-mill tonnage with production of a somewhat higher grade of concentrates.

A change has been made in the concentrate-handling system within the past year. At present only one-third of the production is being delivered into the old combination Dorr thickener and Oliver filter installation; the other two-thirds flows by gravity direct from the cleaner cell into a recently acquired Oliver Dorreo filter (6F6—12x6 ft.), installed in the same building. The filter cake produced here is of approximately 5 per cent moisture content and is handled by a belt conveyor system to the remodeled loading station, where it may either be collected in a separate bin for moist shipments or delivered to the Lowden dryer for further moisture reduction.

The flotation reagents in use at present are as follows:

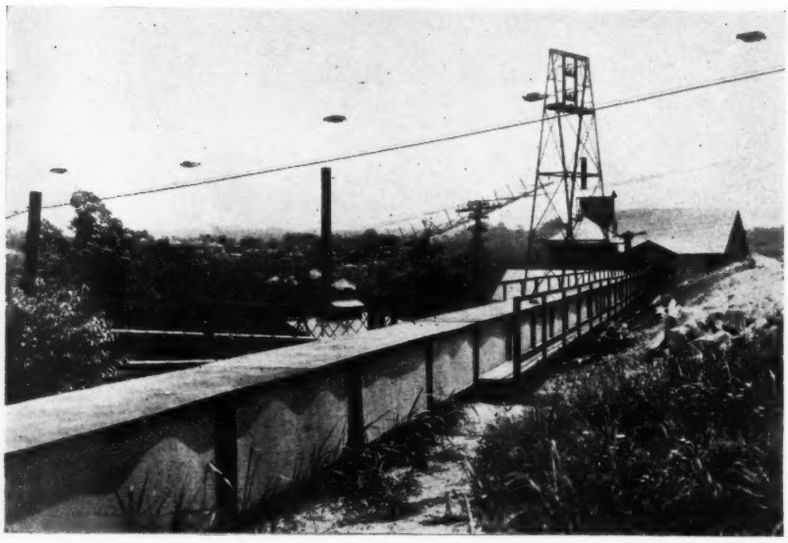
	Pounds per Ton of Ore Treated
Copper sulphate	0.58
Sodium Aërofloat	0.076
Pine oil—Naval Stores Co. No. 5	0.185
Barrett oil No. 634	0.156

Sodium Aërofloat was introduced to replace thiocarbanilide in 1931. It has proved to be a cheaper reagent, is very efficient, and capable of producing a somewhat higher grade of concentrate. Copper sulphate and sodium Aërofloat are used as solutions, and all solutions and oils are introduced into the mill feed by means of recently installed Denver Equipment Company automatic reagent feeders.

Flotation metallurgical results continue very satisfactory. The recovery shown in this department at present is about 97.00 per cent. It is now producing 50 per cent of the total mill concentrate tonnage and rejecting as tailings from 35 to 40 per cent of the total ore tonnage delivered from the mines. These tailings, at a dilution of about 2½ to 1, are disposed of as formerly by being pumped to the storage pile of the American Limestone Company.

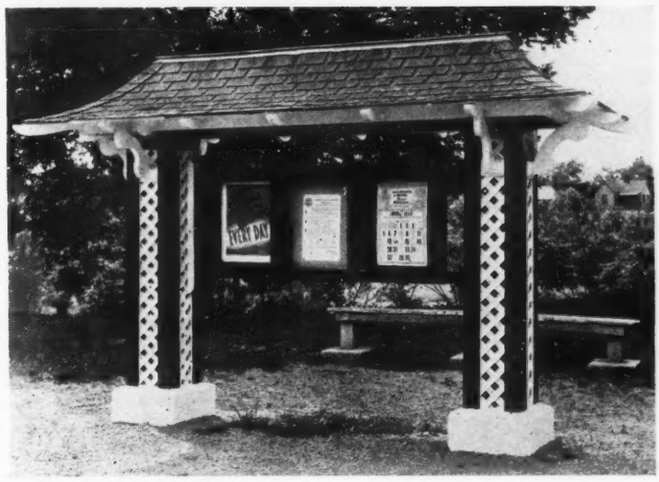
Drying Plant—During 1937 and in the first half of 1938 the drying plant was enlarged to accommodate moist concentrate storage and shipment. A 2,500-ton bin with mechanical car-loading equipment is provided for this purpose.

This department receives jig concentrates by gravity tram, one-third of the flotation concentrate production by a pump line into the combined Dorr thickener-Oliver filter installation and two-thirds of the flotation concentrates by means of a newly installed belt-conveyor system, which delivers filter cake from the Dorreo filter at the flotation plant. This drying and shipping plant, with the new facilities, is now so equipped that concentrates may be shipped at any desired moisture content, and as either straight jig or flotation or any mixture of these two.



Two-thirds of the flotation concentrates from the Mascot mill are delivered to the drying plant and loading station at the railroad via this covered conveyor

At the concentrate drying plant at Mascot. The scraper handled by the double-drum hoist drags the concentrates to the belt conveyor which delivers it to the dryer



This bulletin board is standard for the company's various plants. Here safety reports and other notices are posted

Employee Relations Excellent At Mascot

Personnel department established nineteen years ago has been highly successful. Safety and welfare efforts have yielded results

P. M. Arthur
Director of Personnel
American Zinc Company of Tennessee
Mascot, Tenn.

WHEN the American Zinc Company of Tennessee started operations in Knox County, Tenn., it was confronted with numerous problems other than those of sinking shafts, developing orebodies, and concentrating ores. Prior to the ownership of the Mascot properties by the company, zinc mining in this district had been carried on in small, scattered properties, most of which were inactive. This meant that no experienced labor was available, and it was necessary to develop man power as the operations progressed. The parent company owned mines in other metal-mining districts, and from these fields came a few experienced men. There were also a few copper miners, and the usual floating has-been miner, to draw from. None of this labor stayed very long, so energies were concentrated on making miners and mill men from local residents. These people are of the purest Anglo-Saxon strain, and have proved themselves to be capable, loyal and ambitious, many now holding jobs of responsibility and leadership.

To get a perspective, one must look back to the early days of Mascot when there was only one shallow shaft, a dilapidated old mill, half a dozen scattered farm houses, a railroad station, and a post office, with the nearest city 14 miles away. Under such conditions the town had to be built, the mines developed, and the mill constructed, all at the same time.

It was first necessary to house the construction crews, and, as was customary in those days, tents were scattered here and there, and boarding houses of unsightly design and unhealthful environments were put up without much forethought. This era was followed by better houses, where a man with family would be encouraged to stay. A commissary was organized, roads were built, a drinking-water plant was installed, and the outlines of a permanent industrial town were established.

After the shafts were sunk and the mill approached completion, more thought and time were given to the development of the town. School houses, churches, and recreational buildings were constructed. However, during these early years, labor at Mascot was on the move, and as the World War came on, labor shortages developed here, as elsewhere. The contact between man and management was remote, with different supervisors having their own administrative methods. All this had to be synchronized, and a better understanding followed.

In 1919 methods for promoting modern industrial relations were adopted and a personnel department was established. All labor was handled through a central employment office, and physical examinations were required of all employees. Complete employment records were kept. In addition to employment details, the Personnel Department took over the supervision of safety, rentals, welfare, sanitation, and insurance.

From the very beginning there has been a Medical Department under the able supervision of a full-time doctor, assisted by a visiting nurse. This department works hand in hand with the Personnel Department, and through their mutual efforts health and living conditions have been developed to a point unsurpassed in any other mining community. All employees pay a nominal fee monthly, which is applied to the promotion and maintenance of the health and general welfare of employees and their families. The company provides medical services and drugs necessary for the health of employees and their families while living on company property.

The visiting nurse, in addition to her duties as assistant to the doctor, keeps in constant touch with employees' families, advises in case of sickness, and promotes proper health activities and living conditions.

Among one of the first major undertakings to bring management and men into closer accord was the establishment of a mutual organization, known as "Industrial Democracy." This was a profit-sharing undertaking, and was composed of a Cabinet, a Senate and a House of Representatives. The Cabinet was made up of the executive heads of the company, department heads comprised the Senate, and the House of Representatives was made up from the rank and file. Members in the House were elected from the entire working body, there being a representative for each twenty men employed. There were two Houses of Representatives, one of white men and one of colored men. These bodies met weekly and kept detailed minutes of their proceedings and forwarded any

suggestions they cared to offer to the Senate for consideration. The only qualification for an employee to become a member of either House of Representatives was to have been in the employ of the company continuously for one year. At these meetings the men were free to discuss any subject they cared to. This included mainly general operating conditions, wages, hours of employment, safety, housing, and welfare. The Senate also held weekly meetings where the members considered the communications sent to them from the Houses of Representatives. Usually the Senate was able to dispose of the recommendations, but where conditions arose beyond their authority, or where a matter of policy was involved, the recommendations were forwarded to the Cabinet for consideration and advice.

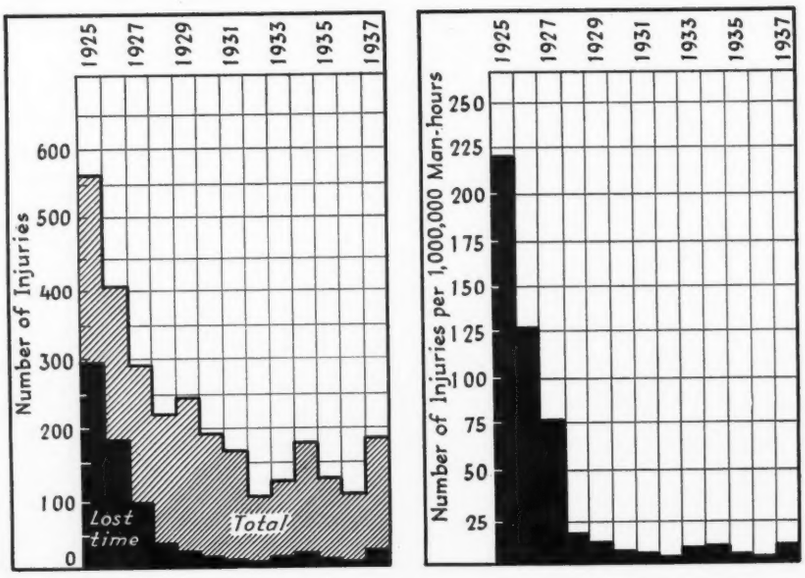
Certain cost figures had been established as a fair basis on which to compute earnings, and the employees were told that the company would split with them fifty-fifty on all savings made. The individual's share of the earnings was proportioned in accordance with his earnings and time worked. The cooperation that developed was quite remarkable, and the actual money saved by the company and made by the employees was far beyond expectations. A different spirit prevailed and Industrial Democracy at Mascot was acknowledged by almost everyone to be a success. This organization functioned from May, 1919, and was quite active until the end of 1920, at which time business dropped off and erews were materially reduced. Business continued to decline, and by the first of 1921 the employees felt that their interests were being taken care of as well as could be; that they were satisfied with the relationship with the company; and that it was not necessary to continue the Industrial Democracy organization any longer. Meetings were held, and by mutual agreement of the two Houses and the Senate, the organization was disbanded. The barriers which had prevented the individual or a group of workers from approaching the management with their troubles or suggestions had been broken down, and management had also realized that the individual workers were in a position to help make costs and improve the cooperative relationship if their ideas were not ignored.

Another feature of company personnel activity inaugurated about this time was a plant publication. This was issued monthly and was contributed to by the entire community: local happenings were described and pictured and some keen competition arose in various phases.

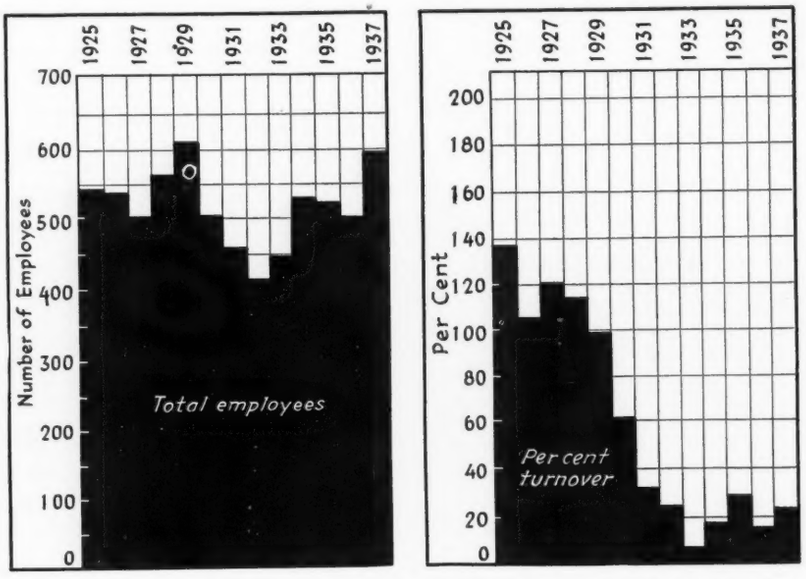
There were two community centers, one for the white employees and one for the colored, and systematic programs were continuously carried on. These activities dealt not only with the children, but also included adults. On holidays special games and entertainment were arranged. These were gala days, which were remembered for weeks. Tennis courts, base-ball diamonds, swimming facilities, and recreational parks for band concerts and out-of-doors gatherings were provided.

During these first pioneer years churches and schools were built, and from irregular Sunday services of the early days the town now has two well-organized churches with large regular Sunday attendance and growing Sunday schools. The school that was started as a one-room country establishment is now housed in a modern twelve-room building with all grades from primary to junior high and with an average attendance of about 375. The building is provided with modern domestic-science and manual training equipment, and has a large gymnasium with seating capacity of 500.

All of these various recreational activities have had their cycle. In other words, when the town was first started it was an isolated community, and, therefore, it was necessary to have local amusements, but as the automobile came in and roads were improved, the people tired of local recreation and gradually went elsewhere for their picture show, ball games, or Sunday entertainment. Mascot is only 14 miles



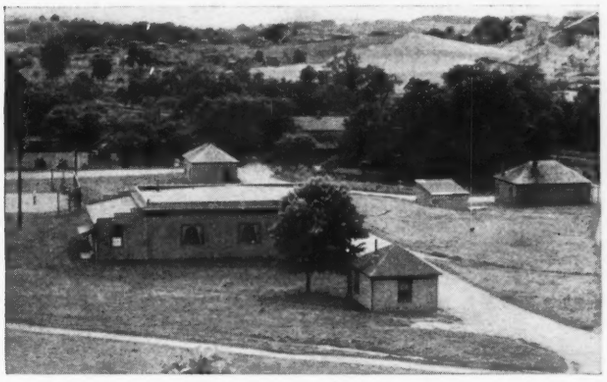
Safety work has borne fruit, as these two curves show. That on the left gives the number of injuries by years from 1925 to 1937 inclusive, revealing a reduction of 95 per cent. The right-hand curve gives the number of injuries per 1,000,000 man-hours



Labor turnover has been reduced markedly, as the graph on the right indicates. The total number of employees reached its peak in 1929, although that of 1937 almost equaled the former, as shown by the curve on the left

from Knoxville. However, the company still maintains all of the parks, community halls, base-ball diamond and tennis courts, to provide for the amusement of the younger generation.

Among the organizations that have contributed largely to the upbuilding of the proper community spirit has been the Parent-Teachers' Association, and this brings to attention the local library, which was started as a private undertaking by the Woman's Auxiliary to the American Institute of Mining and Metallurgical Engineers, and finally was taken over by the Knox



A community center for white employees and their families at Mascot. The different buildings house the doctor's office and emergency first aid station, the library, and the community hall

Employees' homes at Mascot. The company owns 225 houses of all classes for both white and colored employees. They are rented at nominal rates and kept in good condition

County Library Service, and made into a rural branch, with a weekly circulation of about 750 books.

Mascot is situated in the picturesque Holston River valley, and the town is only a short distance from the river. It was laid out with the idea of providing homes rather than merely places in which to live. Rents are nominal and include lights and water. All water for domestic use is treated by a modern filtration plant. Water analyses are made regularly by company chemists as well as by the State Board of Health, and sanitation is one of the important considerations. The company operates a farm on which is maintained a thoroughbred Guernsey milch herd, which furnishes milk to the company employees at a price below the average of the district.

Accident prevention has been one of the major objectives and safety work has been considered as important as production. Even in the early days of operation the policy was to make safe working places for the employees, but as time passed and more was learned about safety methods, and as the individual also realized what an injury meant to him, remarkable strides were made in reducing accidents.

Labor turnover has a definite effect on accidents. In 1925 the turnover was 136 per cent. In recent years it has been as low as 5 per cent. There have been some fluctuations caused by curtailments, which were made necessary by unsettled business conditions.

In April, 1935, the American Zinc Company held a reunion in commemoration of the 25th anniversary of the starting of its operations in this district. Former employees who had been in the organization in its earlier days, returned for the occasion, and one of the outstanding features of the event was the presentation of service awards to employees that had been in continuous service of the company for fifteen and twenty years. Gold lapel buttons were presented to 58 employees that had been in the service over twenty years, and silver buttons were presented to 68 employees that had been in the service over fifteen years. On the present payroll, 53 per cent have been in company service for more than ten years, and fifteen per cent have been in the employ of the company for more than twenty years.

Several different methods have been tried to determine the best way of preventing accidents and administering safety activities, but all have been based on the utilization of safety committees. The most successful set-up has been as follows: A general safety committee is appointed by the management, and serves for one year. All safety activities and prevention work are directed by it. Regular meetings are held and periodically there is a general meeting of all department heads and foremen. These are generally dinner meetings held in the evening, which are informal, and free discussion is entered into by all.

The general committee appoints regular inspection committees, which are chosen from supervisory as well as rank-and-file employees. It also investigates all lost-time injuries and makes written reports of its findings. These reports appear on all bulletin boards, and place the cause and the responsibility of the accident, and suggest ways and means to prevent the recurrences of similar accidents.

Monthly departmental safety meetings are held by each department, with a representative number of employees present. The personnel is rotated, so that all employees are reached and given an opportunity to express themselves on safety as well as on operating problems. Each department head acts as chairman of these meetings, written minutes are kept, and safety suggestions offered are conveyed to the department to which they apply. It then becomes the duty of that department to have the work done, or to make a written report to the General Safety Committee, stating why such suggestion cannot be put into effect.

The injury curve of this company has been extremely gratifying. There has been a reduction in lost-time injuries of 95 per cent between the present-day yearly experience and that of the early days. In recent years employees have evinced an unusual interest in safety, and considerable competition has developed among the various departments in striving to go an entire year without a lost-time injury. In 1936 Mascot Mine No. 2 accomplished this goal, and a dinner and entertainment was given the entire crew in celebration of this notable record. This mine operated from Oct. 14, 1935, to Jan. 5, 1937, without a lost-time injury, having worked 346 days with 499,650 man-hours of exposure. In recognization of this performance this mine was awarded a certificate of honor by the Joseph A. Holmes Safety Association. In 1937 five surface departments worked the entire year without a lost-time injury, with a total of 372,230 man-hours of exposure.

All employees carry personal life and accident insurance. This is a group coverage, taking in occupational as well as non-occupational disability. Last year this coverage was supplemented by sickness and family funeral benefits, and was subscribed to by over 90 per cent of the employees.

TRI-STATE ACTIVITIES

Diverse Interests Mark Work in Tri-State District

Parent company operates its American Robinson property, leases its mineral lands, buys concentrates locally

G. W. Johnson
Tri-State District Manager

J. W. Gilbert
Operating Superintendent

American Zinc, Lead & Smelting Company
Joplin, Mo.

AMERICAN ZINC, Lead & Smelting Company has owned mineral lands and lease rights in the Tri-State district for nearly 40 years, or since its incorporation, in 1899. Throughout the period it has both produced and purchased zinc and lead concentrates for consumption in its smelters and oxide plants now situated in East St. Louis and Hillsboro, Ill.

Mining operations at present are limited to one property, the American Robinson, situated approximately a mile northwest of Treece, Kan., where highly selective mining methods are used in the recovery of the comparatively rich ores deposited in low, narrow runs closely following very definite and distinct fracturings of the rock formation.

Though the better values occur in the "M" bed, as described by George M. Fowler and Joseph P. Lyden,[1] considerable mining has been done in the ore horizon likewise designated as the "K" bed, and some tonnage has been drawn from their "G" and "H" beds. The practical application of this structural geology has been helpful in the mining, as well as the discovery by churn drilling and the development by shaft and drifts, of these ore deposits. A map of the Robinson mine workings, carrying various floor and roof elevations based on sea-level datum and contours of the top of the "M" bed, shows a considerable variation in the depths of the ore occurrence in this ore horizon and of the bed itself. With sufficient geological information ahead of mine developments, the most efficient and economical operations might be arranged, but it is more often the experience, as has been true on the Robinson lease, that much of this valuable knowledge has been obtained following, rather than preceding, underground developments and subsequent mining. However, current benefits of considerable importance are derived from the data at hand, as well as a continuous study of the formations and structures encountered, both in the progress of underground operations and churn drilling from the surface.

As previously stated, practically all of the remaining ore of known commercial value occurs in low, narrow runs with little or no uniformity as to elevation, all of which makes for high per-ton costs of rock, and particularly so when every possible effort is made to mine the better ores selectively without any more dilution with waste than is necessary. The concentrate cost is given first consideration, and it has been found the mining methods employed, considering both physical and market conditions, yield the best results in this respect.

Drilling of the ore is done with Ingersoll N 70 and Denver D 89 rock drills, using $1\frac{1}{8}$-in. round hollow steel. The broken ore is hand-shoveled into steel tubs holding 1,200 lb. of dry ore, and is then conveyed to the shaft on 18-in. gage flat-top cars drawn by a Mancha storage-battery locomotive, with the assistance of mules in isolated stopes.

An English hoist powered with a 125-hp. General Electric motor is used for raising the ore to the surface and dumping it in the mill hopper. The mine is kept drained of surplus water with a 6-in. Gould Triplex pump driven by a 50-hp. General Electric motor, and a fully equipped 5-in. Gould triplex pump is maintained for emergency service. Two Ingersoll-Rand Imperial Type-10 air compressors with a total capacity of 2,000 cu.ft. per minute furnish air for underground machine drilling and the sharpening of steel with an Ingersoll-Rand No. 50 sharpener in the surface blacksmith shop.

The ore is treated in a modern concentrating plant equipped with Cooley jigs, Butchart and Wilfley sludge tables, and Butchart flotation machines, with all necessary grinding equipment, including a Harding $5\frac{1}{2}$x 22 ball mill. An American 6-ft. four-leaf filter is used for reducing the moisture content of the flotation concentrates. Tailings losses are comparatively low, the jig waste over the past five months averaging but 0.90 per cent zinc, the table tails 0.80 zinc and the flotation tailings 0.30 zinc. Daily samples are taken of all tailings by Galligher automatic samplers, and an average sample is prepared from each department for analysis once in every two-week period unless difficulties arise in the meantime requiring an assay sooner for a given shift or series of shifts. The zinc concentrates run uniformly high grade from 60 to 63 per cent. The lead concentrate averages 79 per cent.

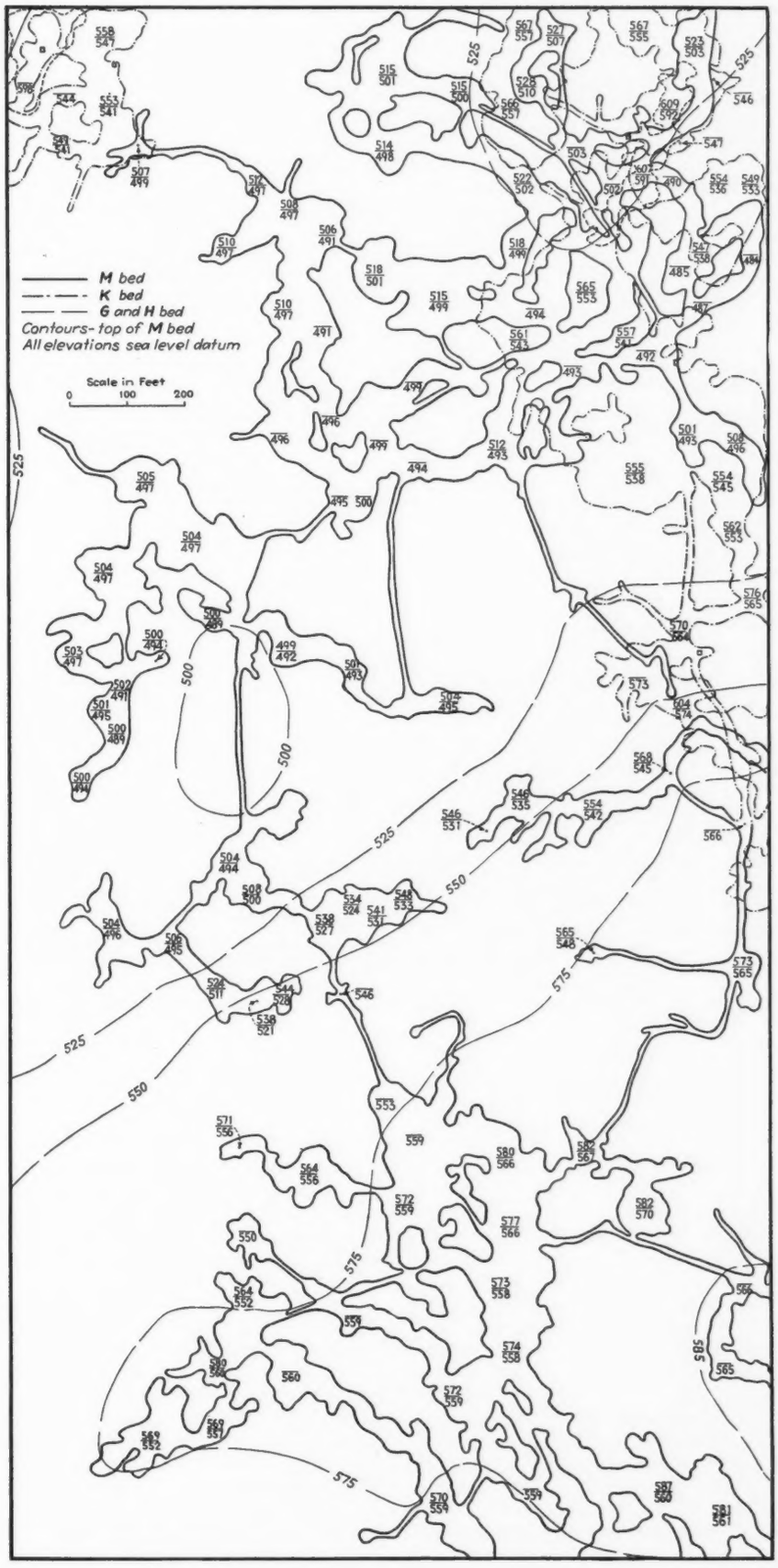
Much attention is given to providing safe working conditions for all employees, and, with the full cooperation of the superintendent, the foreman, and the men themselves, the results obtained have been gratifying. The figures in the accompanying table cover operations for the past $3\frac{1}{2}$ years.

Ventilation is also given much attention, and all muck piles are wet down before shoveling, to keep the

Accidents Per 1,000 Shifts

Year	Lost Time	No Lost Time	Total
1935	0.86	1.72	2.58
1936	0.89	1.32	2.21
1937	0.52	1.01	1.53
1938	0.25	1.00	1.25

[1] T.P. 532-I, 45. A.I.M.E., February, 1934.



This map of the workings of the American Robinson mine, near Treece, Kan., shows various floor and roof elevations based on sea-level datum and contours of the top of the "M" bed, revealing variation in the depths of ore occurrence in this horizon and of the bed itself

Stratigraphic Section, Boone Formation[1]

B to M Beds, Inclusive

Bed	Thickness, Ft.	Characteristics
B	0–40 (depending on erosion)	Light brown and gray limestone and dolomite, some white and light-blue chert
C	25–32	White and blue chert, brown and gray limestone and dolomite. Usually more dark-blue chert in bottom 10 ft. of horizon
D	20–25	White cotton rock, some hard, white chert, white and light-brown limestone. Tripoli in this horizon where limestone has been leached. Contains commercial orebodies in a few mines
E	5–8	Gray and brown chert and white chert nodules. Brown linestone and dolomite. Important ore bed in some mines. Contains mostly galena
F	12–15	Light-brown limestone and white cotton rock. In areas of complete chertification is dense white and light-gray chert
G	10–12	Important ore horizon in many mines. Ore occurrences in this and H bed are generally similar, but this bed is more extensively mineralized. In some mines G and H beds both contain ore and are mined together
H	13–15	G and H beds usually thin-bedded, alternating limestone and cherty bands 2 to 5 in. thick. In minable areas the ore bands are from ¼ to 2 in. thick and replaced similar thickness of limestone. The galena and sphalerite are usually banded with galena on top
J	4–5	Brownish and gray limestone and chert, or soft greenish limy stratum usually containing glauconite. Mineralized only in areas of intense deformation. Bottom of Warsaw formation. Probably small unconformity
K	8–12	Top of Keokuk formation. Important ore bed. Comprises rounded nodules 5 to 9 in. in diameter in upper part of bed with long, larger nodules in lower part. Ore generally confined to upper two-thirds of bed. Short Creek oölite, 5 to 8 ft. thick, occurs in this horizon in some areas. Oolite is found from top of K bed to bottom of L bed
L	26–30	Massive limestone, massive grayish chert or cotton rock. Contains ore in zones of intense deformation. In places contains 5 ft. stratum of oölite
M	19–22	One of the most important ore beds of Oklahoma-Kansas area. Where metamorphosed, definite nodules 4 to 12 in. in diameter occur throughout bed. In many places large nodules (6 to 12 in. thick by 2 to 5 ft. in diameter) at bottom of bed. Ore-bearing part of this bed in different areas of Oklahoma-Kansas field varies in thickness from 5 to 22 ft. Bottom 12 ft. is most productive horizon

[1] Reprinted from T.P. 532-I, 45. By George M. Fowler and Joseph P. Lyden. A.I.M.E., 1934.

air fresh and well within the permissible dust count. All men are handled in the shaft in an inclosed safety can, and every other precaution is taken to avoid shaft accidents.

In addition to its own productive operations, the leasing of its mineral lands has always been an important phase of American Zinc's activities in this district. The shallow ores are usually mined by an individual operator or a group of individuals; the deeper ores are generally leased to the stronger companies financially able to carry on more extensive operations. At Oronogo, Mo., for instance, the Oronogo Mutual Mining Company

holds the right to mine ores below a certain sea-level elevation on several different tracts of American Zinc's land, and these ores are worked in conjunction with underground operations on adjoining and near-by lands of other ownership.

Ore tonnages mined from the various tracts are determined by survey at the close of each month, and royalty payments are made in accordance therewith, the recoverable grade of the ores mined being the average of the total production from all lands on the assumption all ores are of equal grade. The entire production of the Mutual company for the past two years has been shipped to the Eagle-Picher Central mill at Cardin, Okla.

The Mutual company also holds the lease rights to mine all the ores above that certain sea-level elevation on one 40-acre tract well known over the district as the Oronogo Circle, where caving operations were unsuccessfully undertaken several years ago, following other lessees will also be taken to this company's Oronogo plant for treatment.

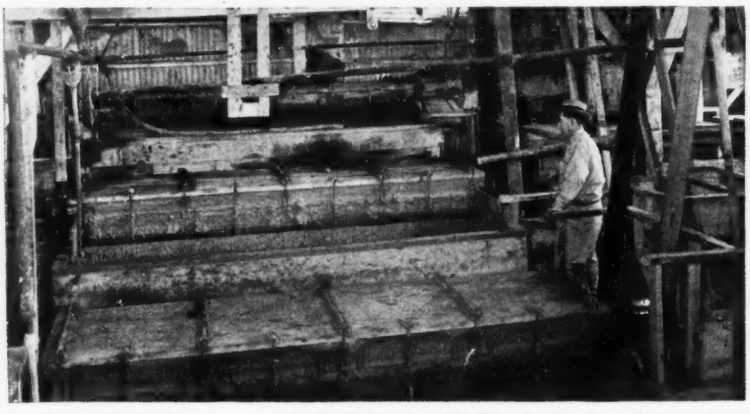
Though available data for use in calculating proved ore reserves are not markedly comprehensive, Mr. Waring, and others familiar with past operations on the land, conservatively estimate large tonnages of high-grade ore suitable for treatment in the Eagle-Picher Central mill and an equal tonnage of low-grade or otherwise unsuitable ores that can be treated economically in the Diamond mill, at Oronogo.

The dewatering of this old mining field was started in January, 1935, by Frank Childress and associates, and, with the subsequent cooperation of the Eagle-Picher Mining & Smelting Company, the mines were reopened for productive operations in July, 1936. Assuming that the cooperative efforts of all interested parties are continued, this general area will without doubt yield substantial ore tonnages that will in turn produce a very

this unit value applying as a premium for any zinc content above 60 per cent or as a penalty when below base grade down to 56 per cent, and thereafter the penalty is $1 per unit; also, penalties at the rate of $1 per unit are charged for iron in excess of 3 per cent, lead in excess of 2 per cent, and lime in excess of 1½ per cent. If the respective assays of the buyer and seller check within seven-tenths of 1 per cent, settlement is promptly made on the average of the two; otherwise, the umpire sample is submitted for analysis and the assay nearest the umpire or umpire assay is used.

Lead concentrates are purchased and handled in the same manner as zinc concentrates with the exception that weekly open-market quotations are based on 80 per cent lead content and the premiums and penalties for lead content above and below 80 per cent are usually calculated at unit value. Low-grade lead concentrates are rare, and when offered for sale they are generally bought on a flat

Ore haulage in "cans" in the American Robinson mine, near Treece, Kan.—the only property that the Zinc company is now operating in the Tri-State District



In the Robinson mill. The zinc-lead ore is treated on jigs, tables, and the flotation machines shown here

many years of extensive mining by use of room-and-pillar methods, the trouble then being too much dilution of the commercial ores with waste materials and a long period of unfavorable concentrate markets. Under the able management of Guy H. Waring, who is familiar with all past operations on the land and the remaining ore reserves, the Mutual company has been removing waste from the caved area with an Invincible ¾-cu.yd. shovel powered with a 90-hp. Buda gasoline motor and four 1½-ton Chevrolet and Ford dump trucks. An average of 1,000 tons of waste materials per work day has been moved to adjoining lands since March, 1937, and a substantial tonnage of low-grade ore has been stored for future milling. This ore, along with any other ores from this source that are unsuitable for shipment to the Eagle-Picher Central mill, will be treated in American Zinc's concentrator recently moved by the Mutual company from near Diamond, in Newton County, Mo., to Oronogo. No doubt ores mined by good supply of both high- and low-grade zinc and lead concentrates over the next several years.

American Zinc, Lead & Smelting Company is currently in the market for a substantial tonnage of zinc concentrates and an occasional car of lead, and through its Joplin office between 50,000 and 60,000 tons are handled annually. Purchases are made on Friday and Saturday of each week, and usually the tonnage bought is truck-loaded in railroad cars under contract and shipped to company smelters the following week. Each car, or, if concentrates of two or more grades are placed in the same car, each lot, is carefully sampled by representatives of both buyer and seller.

All flotation concentrates and some of the lower-grade coarse concentrates are assayed for zinc, iron, lead, lime, and moisture; high-grade coarse concentrates are seldom assayed for more than the zinc, iron, and moisture. The market price is quoted on base concentrates containing 60 per cent zinc, price per ton or some other special basis. Most of the district's lead production, however, is purchased under contract whereby the current metal quotation and a fixed treatment charge are used in figuring settlement on a specified recovery of the indicated metal content. All concentrate purchases are generally made by telephone and later confirmed in the form of written agreement.

The company's exclusive holdings of fee lands in Southwest Missouri, both outlying as well as adjacent to and within the limits of several cities, require considerable attention, as much of this acreage is occupied by tenants for dwelling purposes and some large-scale agricultural and dairying operations are carried on under appropriate leases.

In this brief résumé of the interests of the American Zinc, Lead & Smelting Company in the Tri-State district, a diversification is apparent that in itself creates and extends company activities both within and without the zinc industry.

At the East St. Louis Smelter

Slab zinc and anodes, acid, and metallic cadmium comprise its products—Emphasis placed on health and safety work

N. L. Allen
Plant Manager

R. A. Young
Assistant to Plant Manager

American Zinc Company of Illinois
East St. Louis, Ill.

GRANBY SMELTER of the American Zinc Company of Illinois occupies 125 acres in Fairmont City, Ill., one mile from East St. Louis. The plant is equipped to handle both flotation and milled zinc sulphide ores, as well as certain metallurgical residues and byproducts. The products of the plant are slab zinc and zinc anodes, ranging in purity from Prime Western metal to High Grade, 60 deg. Bé. sulphuric acid, and metallic cadmium. Roasting is done on three Nichols-Herreshoff roasters and one Hegeler kiln; acid is made in a lead chamber plant; sintering is done on two Dwight-Lloyd sintering machines; and metal is produced on four Neureuther-Siemens regenerative furnaces.

The 1937 output of the plant was approximately 26,000 tons of spelter and 83,000 tons of 60 deg. Bé. sulphuric acid.

Ore Handling—Most of the flotation concentrate is received daily as used, unloaded direct from railroad cars by drag shovel, and conveyed to steel feed bins on the Herreshoff roasters. The milled, or coarse, ore is dried to less than 1 per cent moisture, and crushed through $\frac{1}{8}$-in. opening, as received, all of this concentrate going to dried-ore storage bins for use in the Hegeler roaster. Ore not being used immediately in the roasters is stored in large concrete ore-storage bins. A new, large ore-storage structure is now being built under the same roof with sintered ore storage and automatic mixing equipment, which will be described later. The raw-ore storage section consists of one large concrete storage bin of 15,000 tons' capacity. Railroad cars can be backed on an incline to a rail directly above the bin. Unloading will be done by power drag. Ore to the Herreshoff roasters will be picked up by a 15-ton overhead crane, which will convey it to weighing bins and thence it is taken to the roaster storage bins by inclined endless belt.

Roasting and Sintering — Coarse concentrate is roasted on standard Hegeler kilns down to 0.5 per cent sulphide sulphur. The kilns are rabbled approximately 45 min., resulting in a fluctuation of SO_2 content in the roaster gas that ranges from 2 to 6 per cent prior to and during the rabbling. The average SO_2 content is about 4.5 per cent.

Calcined ore is cooled by standing overnight in industrial cars before being sent to the sinter-plant storage bins or furnace mix room.

Average feed to the Hegeler roaster for 1937 assayed 0.39 per cent water, 59.72 per cent zinc, 0.84 per cent lead, and 30.34 per cent sulphur. The calcined product averaged 67.96 per cent zinc, 1.13 per cent lead, and 1.96 per cent sulphur. Sulphur elimination was 91.9 per cent complete.

Flotation concentrate is roasted on three 12-hearth, 21 ft. 6 in. diameter steel-shell Nichols-Herreshoff roasters. Roasting is at the rate of 50 to 55 tons of raw feed per roaster-day. Such additional heat as is needed is obtained by burning natural gas, which is used on the twelfth hearth only. The rate of consumption is 900 cu.ft. per ton of feed. Sulphur is eliminated from an average of 30.81 per cent in the dry feed to an average of 3.79 per cent in the finished calcine. Cast-iron arms and rabbles are used throughout the roasters, with the exception that on hearths 2, 3, 4, 5, and 6, Fahralloy rabbles are used. The rabbles have an approximate composition of 25 per cent chromium, 2 per cent nickel, and 1.25 per cent carbon.

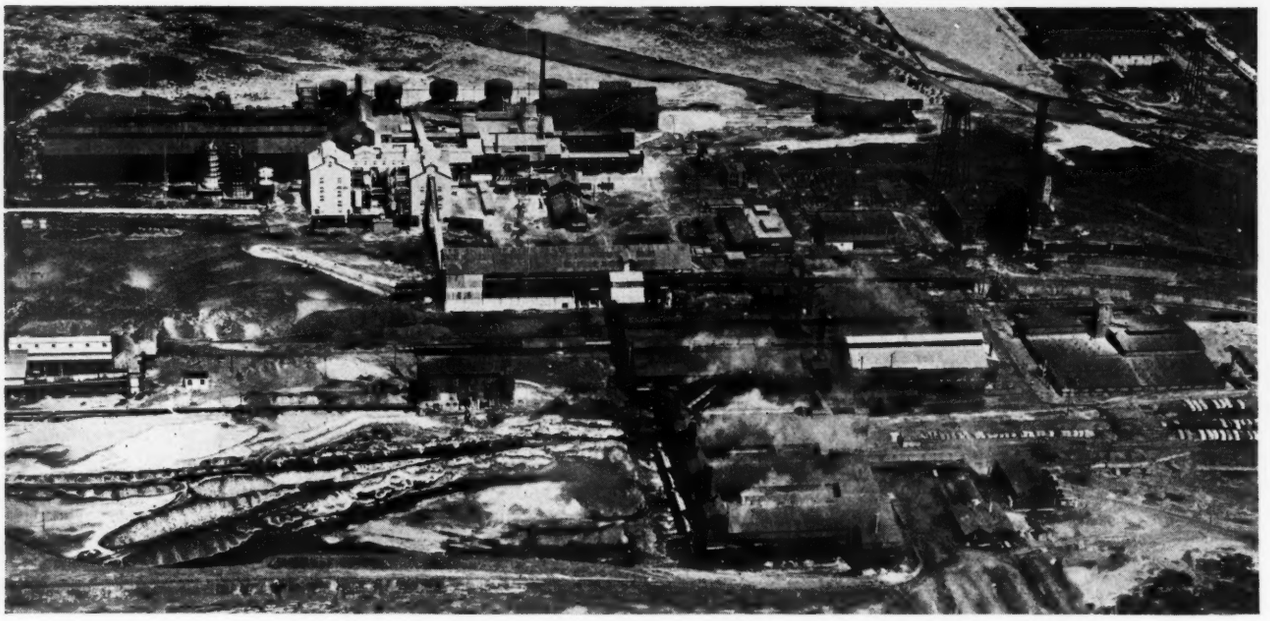
Concentrate with a 10 per cent moisture content is fed to the roaster drying hearth. This drying eliminates approximately 6 per cent of the moisture, so that the feed to the first roasting hearth is about 4 per cent water. The ore is passed over all twelve hearths, being rabbled first to the center, and then to the outside on alternate hearths. The roasted product is continuously raised by elevators to storage bins, where it is cooled prior to sending it to the sinter plant by an endless rubber-belt conveyor.

The moisture content (4 per cent) on the first hearth of the roaster results in the formation of agglomerated masses of unroasted ore varying in size up to a small marble. These agglomerates, as well as the lumps produced by hearth digging, are removed from the finished calcine by screening and are crushed and returned to the roaster with the raw feed.

The amount of air used in roasting is controlled by the speed of the acid-plant fans, the practice being to hold a balanced draft on the second roasting hearth. Gases leaving the roasters carry approximately 6 per cent

Average Analysis of Joplin Concentrates

	H_2O	Zinc	Lead	Iron	Lime	Cadmium
Flotation concentrates.....	10.1	58.09	1.50	1.59	0.96	0.35
Milled concentrates.....	2.7	58.95	0.56	1.25	1.17	0.39



An aerial view of the Granby smelter of the American Zinc, Lead & Smelting Company, near East St. Louis, Ill. It is usually known as the East St. Louis plant, and is so referred to in the accompanying text

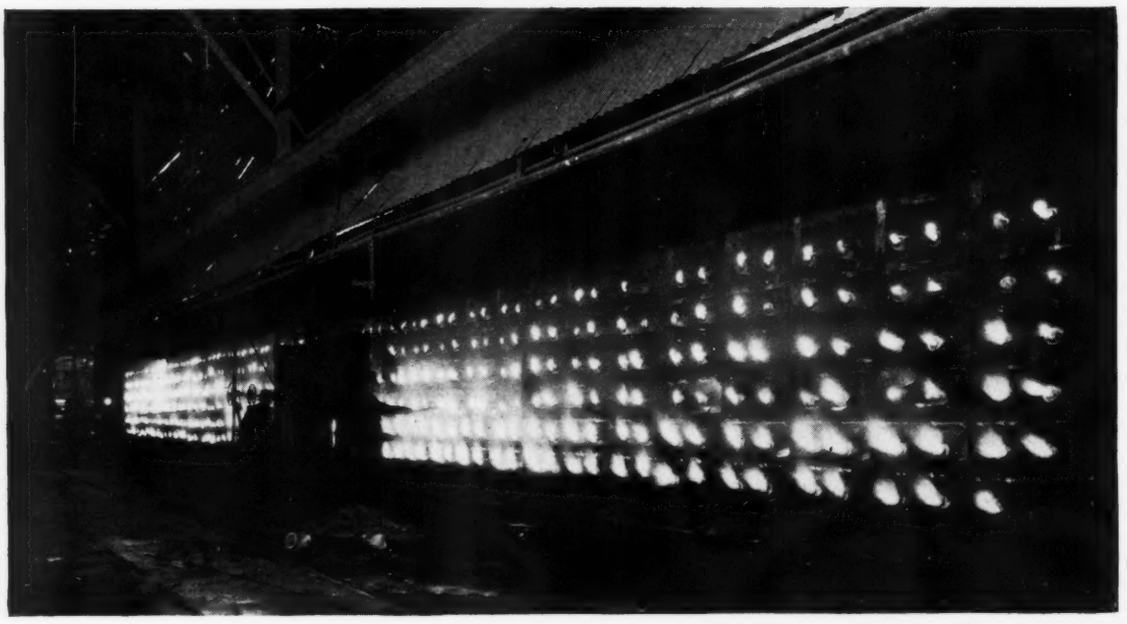
SO_2, and are cleaned by settling in large flues followed by Cottrell precipitators. Flue dust is cleaned out mechanically daily, and returned to the Herreshoffs with the raw feed.

A plate-and-wire-type Cottrell precipitator cleans the gas from two Nichols-Herreshoff roasters. Another precipitator of the same size and type takes the gas from the third roaster. All metal parts exposed to the SO_2 gases are fabricated from special alloys permitting efficient and economical operation at temperatures up to 600 deg. C. Cottrell wire rapping, plate rapping, and opening and closing of dampers are entirely automatic, the sequence and timing being done by a standard motor-driven sign flasher. The wires are rapped for a five-second duration every fifteen seconds; plates are shaken for five to ten seconds every thirty minutes.

Precipitated dust is removed daily, a portion going to the sinter machine feed tanks, and the larger part being taken to the cadmium plant for removal of cadmium and lead. The quantity of Cottrell dust obtained is about 5 per cent of the roaster feed.

The fine Herreshoff calcine with a relatively high sulphur content, unlike the coarse, low-sulphur Hegeler calcine, is not a product suited for direct reduction on the distillation furnaces. It must be treated in such a way as to increase the size of the individual particle, as well as lower the sulphur content below 1 per cent. This is accomplished on two Dwight-Lloyd sintering machines, each being 33 ft. long, 42 in. wide, and having three wind boxes. The machines are fed with a mixture of Herreshoff calcined ore, coke, returned sinter, Herreshoff Cottrell dust, and water. These ingredients are thoroughly mixed in a rotary mixer placed above the sinter machine and then distributed over the grates in a 9-in. bed. Grate dressing of oversized sinter has previously been added to a depth of $\frac{3}{4}$ in. At present the machines are equipped

One of the furnace blocks at the East St. Louis smelter

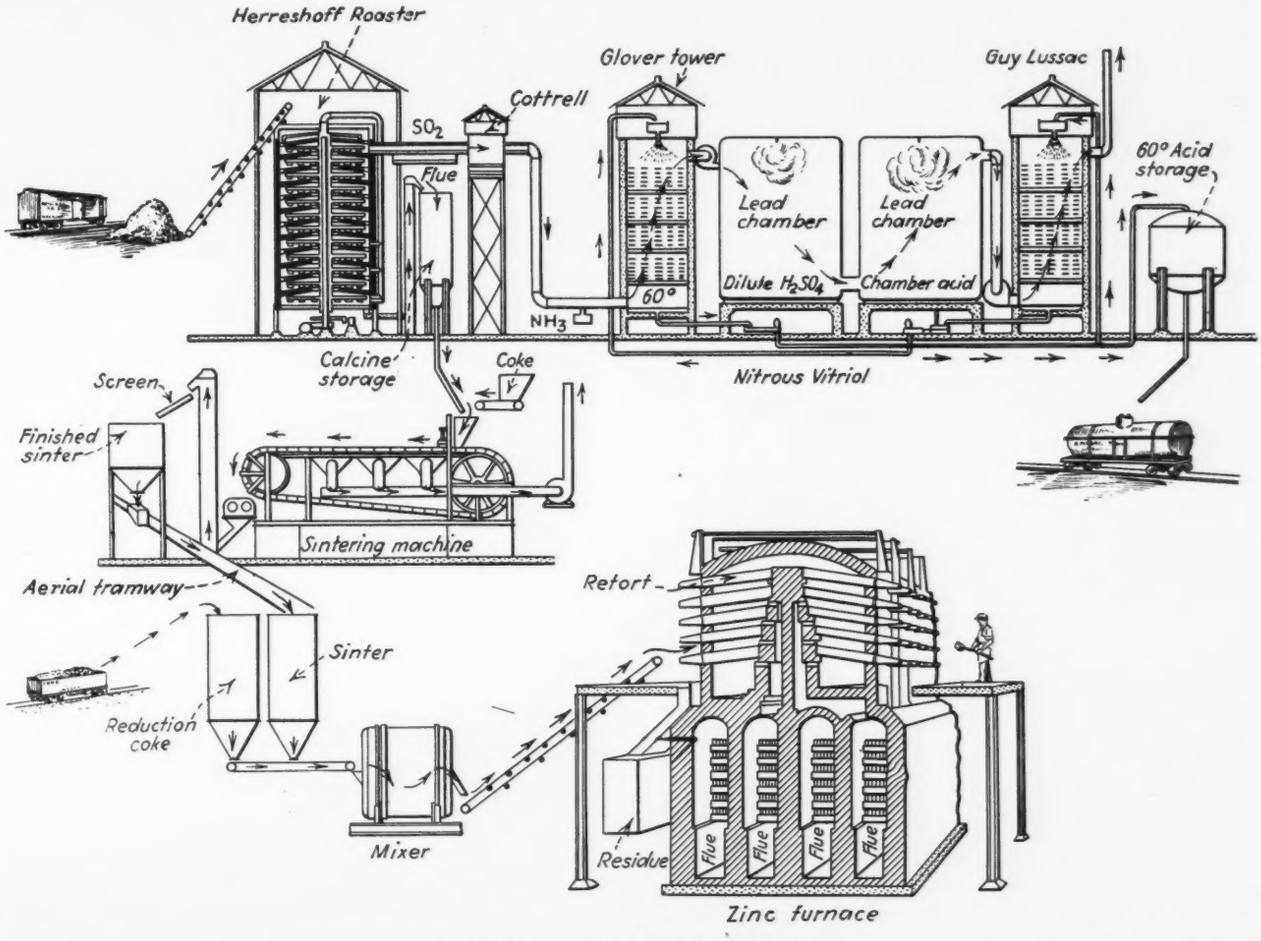


with cast-iron grate bars. The finished sinter cake is crushed and screened. Sinter is produced at the rate of 4 to 5 tons per machine-hour.

All oversized sinter—that is, that which will not pass through a ½x¾-in. opening—is returned for grate dressing, and all fines (that material which passes through 6½ mesh) are returned and mixed in the new sinter feed. These returns amount to 25 to 30 per cent of the finished sinter. The finished sinter is conveyed by overhead tramway to the furnace mix-room storage bins.

The gases from the three wind boxes on each of the two machines are joined in a main and are passed through a four-section wire-and-tube-type Cottrell precipitator. Average gas flow is 50,000 cu.ft. at 200 deg. C. Dust collected in this manner is drawn off daily in barrels and transported to the cadmium plant.

Sulphuric Acid Department—Gases from the Hegeler and Herreshoff roasters are converted into 60 deg. Bé. sulphuric acid in a modern lead chamber plant consisting of Glover towers, ammonia oxidation equipment, rectangular chambers, Mills-Packard chambers, and Gay-Lussac towers. The plant is divided into two systems, the first using gases from two of the Herreshoff roasters, and the second, those from one Herreshoff and the Hegeler. The combined capacity of the two systems is 300 tons of 60 deg. acid per 24 hours. Both systems are identical, with the exception that system No. 2 has only one Glover tower, whereas No. 1 has two smaller ones. The volume and SO_2 content of the roaster gases is practically constant, and, consequently, peaks in acid production are obtained by augmenting the gases by burning brimstone.



A pictorial flowsheet illustrating the process followed at the East St. Louis smelter in reducing zinc concentrates for the production of zinc metal and sulphuric acid

The gases are put through both the roasters and the acid systems by fans placed between the Glovers and the first chambers and behind the last chambers. Each system has nine rectangular chambers, three Mills-Packard chambers, and two Gay-Lussac towers. The chambers are arranged in a combination of series and parallel, which has been found by experience to give the best results. The first chamber is under a pressure of 0.3 in. of water and the last one under 0.1 in. of water. The two Gay-Lussac towers are in series. Acid cooling at the base of the Glovers is obtained by two systems of three lead-coil cooling tanks.

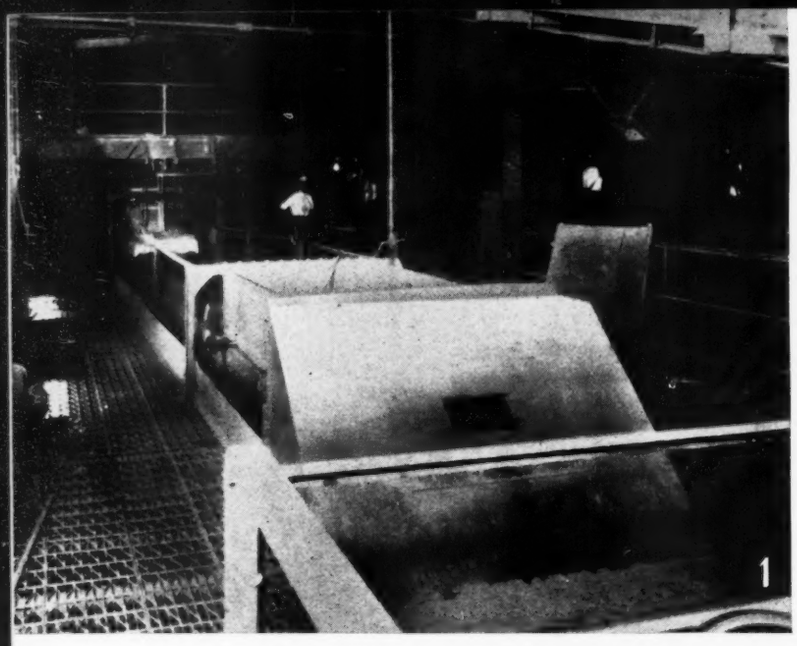
The oxides of nitrogen used in the oxidation of SO_2 to SO_3 are obtained by oxidation of anhydrous ammonia in three catalytic ammonia oxidation units, one being used on each system and the third being held as a standby. These oxides are added at the base of the Glover towers. The water added in the chambers is taken from wells on the property and must be treated in a lime-soda ash system.

Normal acid circulation is about three to four times the daily production, transportation being accomplished by Lewis centrifugal pumps. Control on the system is effected by checking temperatures, pressures, and specific gravities.

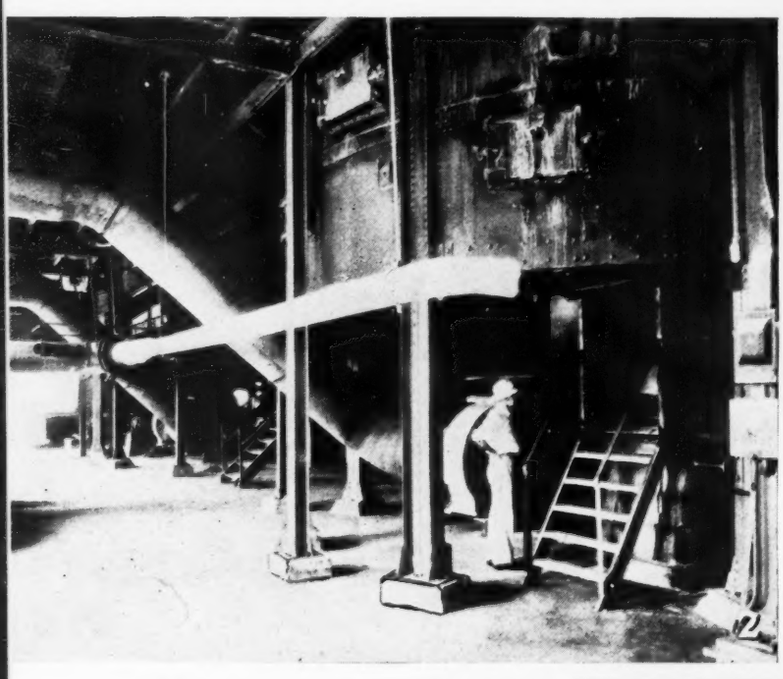
Cadmium Plant—Combustion gases from the two D.&L. sintering machines pass through Cottrell cleaners. The collected dust or fume will assay approximately 15 per cent cadmium, 26 per cent zinc, and 11 per cent lead. Leaching and distilling departments are large enough to treat all the fume of the East St. Louis sintering plant, including dust collected in the same way at the Fort Smith smelter of the Athletic Mining Smelting Company. The arrangement of this plant is such that there is ample capacity for the

IN THE METALLURGICAL PLANTS

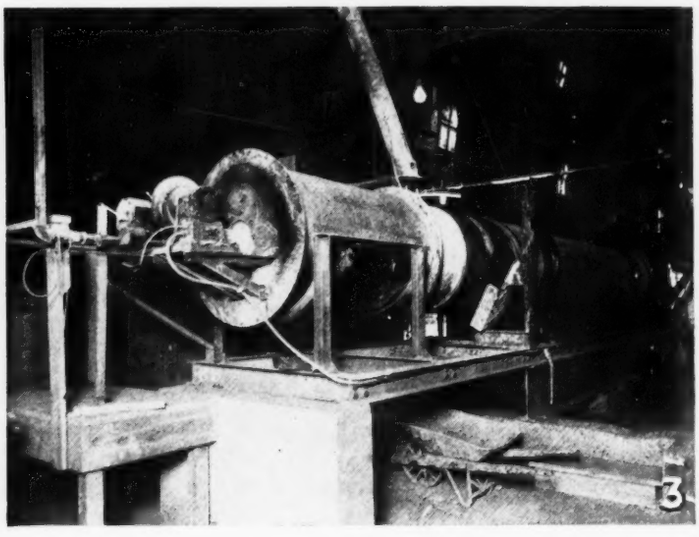
MAKING ZINC METAL, OXIDE, AND BYPRODUCTS



1 Two sintering machines, one of which is seen here, are employed at the East St. Louis plant to prepare the fine Herreshoff calcine for subsequent distillation. This treatment increases the size of the particles and reduces the sulphur below 1 per cent. Each machine is 33 ft. long and 42 in. wide. The pug-mill mixer is on the subfloor directly over the far end

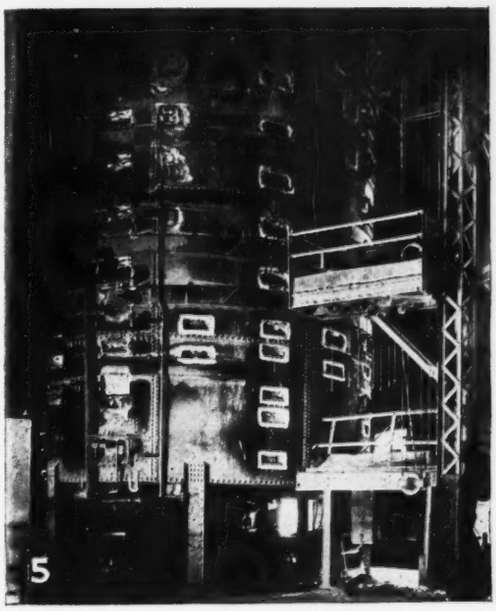


2 Ground floor of the Nichols-Herreshoff roaster building, at the East St. Louis smelter. It houses three 12-hearth units. The large pipes conduct outside air to cool the central shaft and stirring arms



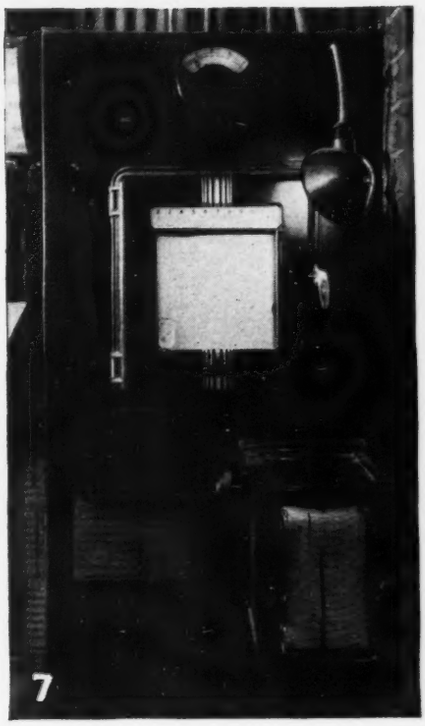
3 Louisville rotary dryer at the East St. Louis plant used in connection with the recovery of cadmium by counter-current water leaching from the dust precipitated by the Cottrell out of the gases of the Nichols-Herreshoff roasters

4 Four Neureuther-Siemens regenerative furnaces are used at the East St. Louis smelter for reducing the sintered crude oxide to metal and its subsequent distillation. Here the condensers of one of the units are being tapped and the hot metal is being run into a ladle on the draw car



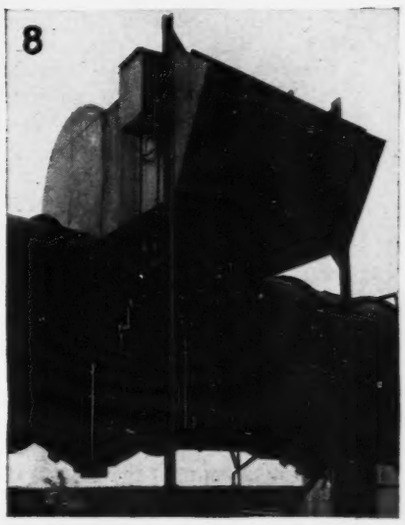
5 Two nine-hearth Wedge roasting kilns at the American Zinc Oxide Company's plant at Columbus, Ohio, roast the zinc concentrates from Mascot. They are brought up to heat with natural gas. The roaster gases are delivered to the acid plant of the Farmers Fertilizer Company

6 Two blocks of Western or tunnel-type furnaces are operated at the Columbus zinc oxide plant, here seen, as also at the Hillsboro plant of the American Zinc Company of Illinois

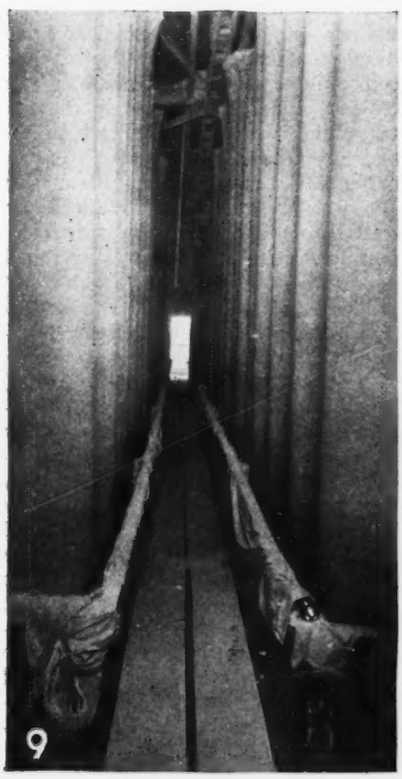


7 Instruments in the Nichols-Herreshoff zinc-ore roasting plant of the East St. Louis smelter. On the Micromax recorder the temperature of each of 12 hearths can be recorded separately

8 Heat regulators in operation at the Columbus zinc oxide plant for maintaining the bag pressure constant



9 A section of the baghouse in the Hillsboro zinc oxide plant. Woolen bags 32½ ft. long and 18 in. in diameter are employed



10 In the furnace block at the Hillsboro plant of the American Zinc Company of of Illinois. The operators are provided with respirators, and also with the Willson supplied air system used for protection against lead poisoning

handling of additional cadmium-bearing materials treated on a custom basis.

The dust is first leached with sulphuric acid in lead-lined steel tanks. After thorough agitation, the slurry is filtered. The filtrate (about 50 deg. Bé.) containing the cadmium and zinc flows to brick-lined lead tanks. Cadmium is precipitated with zinc dust, and the resulting sponge will assay approximately 77 per cent cadmium. Zinc liquor separated by filtration is returned to the sintering plant to wet the feed. The sponge, after drying, is mixed with a reduction fuel, briqueted in a press, then placed into furnace retorts, which are made from standard 8-in. diameter centrifugally cast iron pipe, and are set in the furnace approximately horizontally. The furnace is fired with natural gas under carefully controlled temperature conditions.

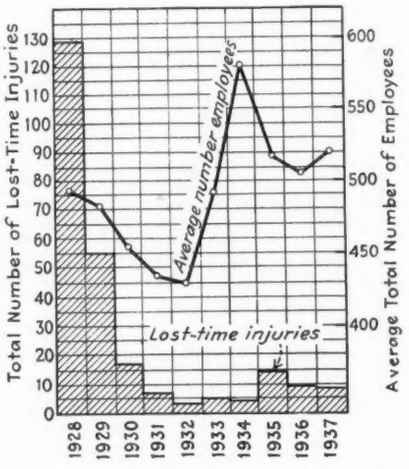
In addition to the acid-treating of sinter-machine Cottrell dust, there is in operation a process for recovering cadmium from the precipitated dust of the Cottrell on the Nichols-Herreshoff roasters by counter-current water leaching. The equipment consists of agitators, Dorr thickeners, an Oliver filter, a Louisville rotary dryer, and suitable pumps for liquids and slimes. The resulting cadmium-rich liquor is added to the sulphuric acid leach liquor before the zinc-dust precipitation. The high-lead cake is resintered to recover the insoluble cadmium.

Zinc-Distillation Furnaces — Four Neureuther-Siemens regenerative furnaces are used for the reduction of the sintered crude oxide to the metal and its subsequent distillation. These four furnaces, of the horizontal-retort type, have a capacity of 30,000 tons of metal annually, ranging from Prime Western grade to High Grade. In existing furnace buildings, space and foundations are provided for three additional furnace blocks. Gas is supplied by Morgan producers, coal consumption being at the rate of about 1 ton per ton of roasted ore smelted, and steam consumption of 0.3 lb. per pound of coal. The gas produced has a B.t.u. value of 140 to 150.

The furnace charge is mixed in a rotary mixer, the sinter being mixed with about 35 per cent reduction fuel, which is coke. Salt is added to the extent of 1.5 to 2 per cent. After mixing, the charge is conveyed to mix bins above the furnace floor. As previously mentioned, there is under construction a new mix room, consisting of a series of concrete and steel storage bins holding various classes of sinter and reduction fuels, as well as other materials that might be used in mixing the furnace charge. Mechanical handling of all materials is provided for throughout. The mixer has a capacity of 260 cu.ft. Benefits expected are better preparation of the furnace charge through more thorough mixing of the various materials and a drastic reduction of handling cost by reason of mechanization.

Two of the blocks, which are five-row, 800-retort units, are charged by hand. A third one, the same size, and a fourth one which is a six-row, 960-retort unit, are machine-charged. The daily cycle, which is started at 4:00 a.m., usually requires five hours for setting up and nineteen hours for distilling. In this cycle, the first operation is charging retorts, followed by the fourth and final draw, and then the discharging and recharging of the retorts. The residues are removed from the retorts by water-pressure sprays.

During the distilling the furnaces are operated under a slight gas pressure, which is controlled by stack dampers for the combustion gases, and air fans for the combustion air and producer-gas main pressure, which is, in turn, automatically regulated at the



Results of the safety campaign in the marked reduction in lost-time injuries are manifested in this graph

gas producers. Gas and air reversals are usually made every fifteen minutes, and a 24-hour reversal of gas and air flow through checkers is made. A distinctive feature of the Neureuther furnace is the partial discharge of air and gas halfway up the combustion chamber by means of vertical ducts with ports in the center wall. The opening of the ports is decreased when necessary by use of small Carbofrax wedges inserted from the furnace front. During the 24-hour day, there are four draws. The only control exercised on furnace temperatures is a reading by optical pyrometer through a retort in the center section which is left open for this purpose.

Blue powder and skimmings—that is, those residues abnormally rich in zinc content—are returned to the mix room, where they are mixed with coke for further reduction. They are then charged in the top rows of the furnaces, which, on this type of furnace, are the coolest.

The condensers, which have a life of about seven days, are crushed when removed, and returned to a jig upon which a 70 per cent zinc concentrate is made. These concentrates are used as part of the mix in the furnace charge.

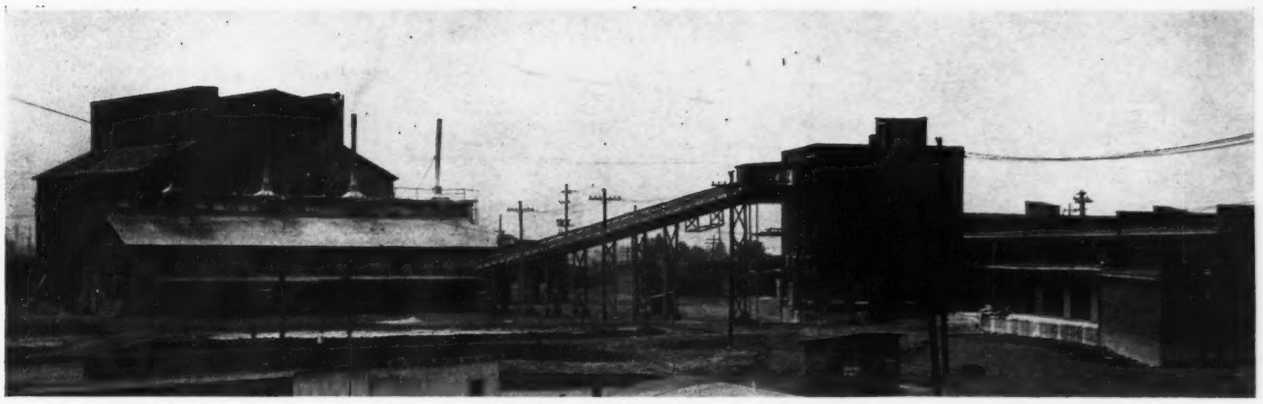
Both condensers and retorts are made in the plant pottery, the retorts being made in a Wettengel press and the condensers in a Garrison-Whipple machine. They are properly dried at the pottery, and burned in kilns on the furnace floor. Before being inserted into the furnace the retorts are brought to 1,700 deg. F. in ten hours with a uniform temperature increase in these kilns. These retorts are 65 per cent SiO_2 and 20 per cent Al_2O_3, and are made from a mix using silica flour, on which mix the American Zinc, Lead & Smelting Company owns the patent. Their average life in the furnace is 43 days. A complete record of every retort placed in the furnaces is kept, so that exact data are available by single retorts, rows, sections, furnaces, and blocks. The retorts in the Neureuther type of furnace vary in length, due to the stepped taper of the center wall. Six different lengths varying from 51 in. to 65 in. are used in the six rows. They have $1\frac{1}{2}$-in. butts, 1-in. walls, and are $8\frac{5}{8}$ in. inside diameter.

The furnace residues, which assay about 10 per cent zinc, are fed into a Waelz kiln, which is really nothing more than a large cement kiln. Here the residual zinc is vaporized and oxidized, the oxide being collected in a conventional type baghouse. This "Waelz oxide" is returned to the sinter plant, where it is mixed in the sinter machine feed.

Metal drawn from the distillation furnaces is cast into 52-lb. slabs, which are either shipped, stored, or sent to a remelting furnace for equalizing.

Plant Safety—Early in 1928 attention was given to organizing a continuous health and safety campaign. Committees were appointed, headed usually by a department superintendent, to serve a two-month term. Their first duty is to make a detailed inspection of the entire plant from a safety standpoint, and to make suitable recommendations. On the average, 95 per cent of such recommendations are carried out before the committee is succeeded by the next one following. They investigate all injuries, and endeavor to devise ways and means to prevent a repetition. Departmental bulletin boards are used to full advantage in carrying the safety mes-

(Continued on page 69)



Part of the zinc oxide plant at Columbus, Ohio. Here Mascot concentrates are roasted and the calcine is treated in the distillation furnaces as major steps in the process of manufacture

Pigments Produced At Two Plants

Columbus and Hillsboro units make zinc oxide, lead-free and leaded, respectively—A pure zinc sulphide is also manufactured at the former

A. C. Eide
Sales Engineer

M. K. Easley
Research Chemist

American Zinc Sales Company
Columbus, Ohio

ZINC OXIDE is produced by the American Zinc, Lead & Smelting Company at two subsidiary plants: the American Zinc Oxide Company, at Columbus, Ohio, and the American Zinc Company of Illinois, at Hillsboro, Ill. Columbus operations are confined to the manufacture of the well-known brands of Azo-ZZZ lead-free zinc oxides; the Azo leaded zinc oxides are produced at the Hillsboro, Ill., plant.

The zinc concentrates (sulphide) for the Columbus plant are shipped from the Mascot, Tenn., property, which mines a sphalerite ore well suited to the production of the commercially pure zinc oxides because of its low lead content. These concentrates will average 70 per cent through a 35-mesh screen and assay 60.5 per cent zinc.

As the accompanying flow chart shows, a system of bucket and belt conveyors makes it possible to convey the raw concentrates directly from incoming box cars or storage bins at the unloading station (1) to the top of two nine-hearth Wedge roasting kilns (2). The concentrates are moved across each hearth by means of alloy rabbles attached to each of two alloy arms which are in turn attached to a revolving central shaft.

The kilns are brought up to heat with natural gas, after which time the heat of oxidation of the zinc sulphide concentrates is sufficient for autogenous roasting temperatures. If, however, any hearth should drop in temperature, provision is made to use natural gas as an auxiliary source of heat. The small amount of combustion gases does not affect the chamber sulphuric acid process.

After the concentrates have been rabbled across the top hearth, which acts to a great extent as a preheating hearth, the stream is distributed by means of bypasses and drop-holes to the lower hearths. By this method, it is possible to maintain relatively uniform temperatures and oxidation on the eight lower hearths. Operating temperatures will average about 950 deg. C. on all of the hearths except the top and bottom hearths, which generally run about 100 deg. C. cooler.

Air for oxidation is blown through pipes in the revolving central shaft and passes through either one or two closed-end arms for cooling purposes. Preheated air is then admitted to each hearth through an open-end arm. The latter differs from a closed-end arm in that it contains a series of outlet holes along the side of the arm and no provision is made to circulate the air through the arm.

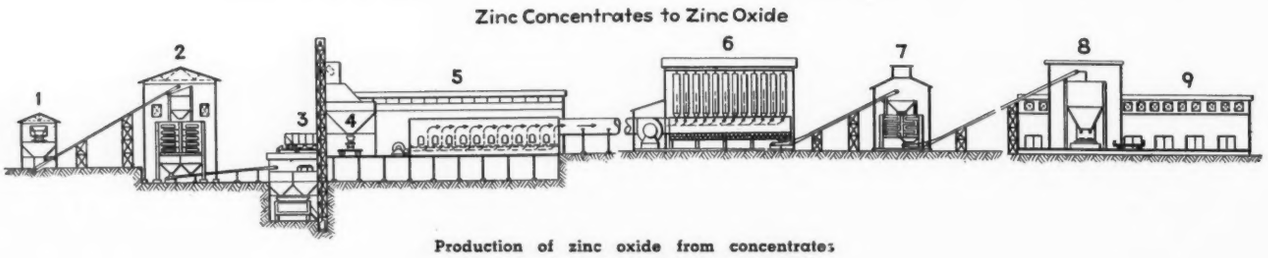
The resultant sulphur dioxide gases are cleaned of dust particles by passing through a plate-type Cottrell precipitator, which usually operates at 60,000 volts, and then are converted to 60 deg. Bé. sulphuric acid.

The American Zinc Oxide Company does not operate a sulphuric acid plant, but, instead, disposes of the sulphur dioxide gases to the adjacent chamber-acid plant of the Farmers Fertilizer Company on a satisfactory contractual arrangement. The Farmers Fertilizer acid plant is equipped with sulphur burners to augment acid production whenever required.

Assays of the calcined concentrates show an average zinc content of slightly above 71 per cent, with sulphide sulphur running around 1 per cent.

The calcined concentrates are transported in industrial cars to the mixing plant (3), where they are mixed with the required amount of smokeless fuel (coal or coke) and hoisted into large charging or storage bins (4) above the furnace floor. The mixed charge is drawn off by gravity into a charging machine, which travels along the side of furnace blocks (5) and mechanically places a charge into each furnace on a regular schedule.

The plants at both Hillsboro, Ill., and Columbus, Ohio, utilize the American process, which has been in use since about 1852, and was so named because it was invented and developed in the United States. It is sometimes designated as the direct process, as it is possible to produce the zinc oxide direct from concentrates. An inter-



Production of zinc oxide from concentrates at the Columbus plant of the American Zinc Oxide Company proceeds as indicated. 1, Concentrate unloading station. 2, Roaster. 3, Mixing plant. 4, Charging bin. 5, Furnace block. 6, Baghouse. 7, Refinery. 8, Packing house. 9, Warehouse

mediate step of first converting the zinc concentrates to metal as used in the French process is, therefore, eliminated.

Two blocks of Western or tunnel-type furnaces are operated at both plants. A block consists of a battery of hearths with a common arch swung over the entire series. Each furnace block at Columbus has eleven hearths with a total grate area of 960 sq.ft. Although the blocks at the Hillsboro, Ill., plant have twelve hearths, the grate area is somewhat smaller—720 sq.ft. Doors are provided on both sides of each hearth for cleaning and leveling the charge, but charging is done from one side only. The hearths are equipped with Wetherill-type cast-iron grates having tapering perforations of $\frac{3}{16}$-in. diameter on the top surface. Blast air is supplied under each hearth by a centrifugal fan (T in the flow chart) having suitable leads and take-offs.

When the furnace is in operation, each hearth is cleaned and recharged in rotation on a schedule that is varied according to furnace burden and type of zinc oxide desired. Generally, a fresh charge is placed on each hearth every eight hours, and is ignited by the residual heat from the hot brickwork of the sidewalls and arch (5).

Usual furnace practice consists of shutting off the blast air and loosening the more or less fused clinker from the grates with long slice-bars. The spent charge is then raked out through the doors, and falls through holes in the furnace floor onto coarse incline screens, which direct the coarse clinker into cars, in which it eventually goes to the dump. Although the charge is well burned out, there is always a certain amount of "fines," which pass through the screens and are returned to the mixing plant.

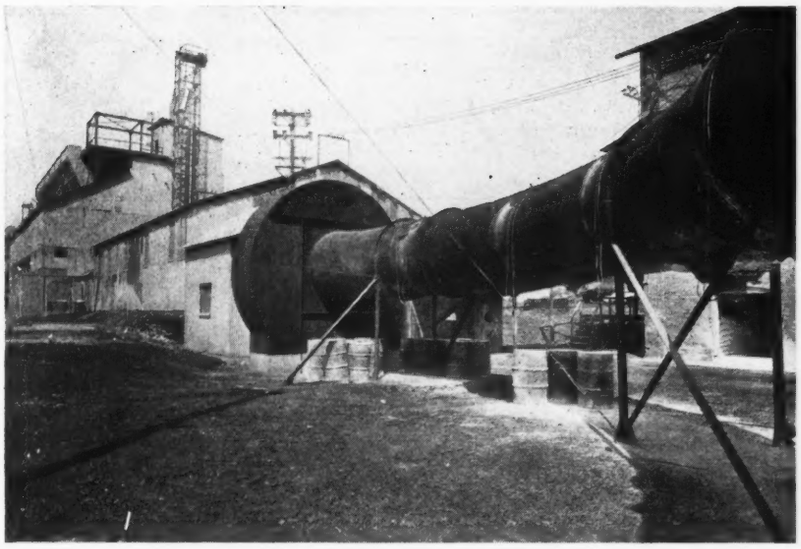
The zinc-oxide-laden gases pass out at one end of the furnace block through heat-radiating brick flues and chambers. Various openings are provided to admit air to insure complete oxidation and facilitate cooling. Additional cooling is accomplished as the gases are drawn through a metal cooling tube or trail, the flow being effected by a large exhaust fan.

Excess air and furnace gases are filtered out by a system of flume bags and collecting hoppers situated in a baghouse (6). The gases enter the baghouse through take-offs from the main cooling trail and discharge into long V-shaped hoppers equipped with a screw conveyor in the bottom. Along the top of each hopper are double rows of round openings fitted with metal nipples to each of which is attached a bag measuring 70 in. in circumference and 30 ft. long and closed at the top.

Various fabrics—cotton, wool, mohair, asbestos, glass, and the like—are used, and all must be loosely woven to insure comparatively free filtration and not impair the suction maintained in the cooling trail. The Hillsboro, Ill., plant usually uses woolen flume bags; but asbestos bags, which permit considerably higher bag temperatures, are in use at Columbus.

The bags are shaken periodically to free the meshes of the accumulated oxide, which falls into the screw conveyor. Each of these hopper conveyors discharges into a large collecting screw conveyor. By means of a mechanical distributor, the "stream" is equally divided among four refineries (7), where the zinc oxide is subjected to additional heat-treatment to improve the color and chemical composition, and to eliminate colloidal particles. From the refineries the oxide is screw-conveyed onto a long, slow-moving pan conveyor, which allows sufficient heat radiation before discharging onto a large rubber-covered belt conveyor. This conveyor transports the oxide to the third floor

The Hillsboro zinc oxide plant (see also the view on page 41.) It works on calcine from the East St. Louis smelter. Part of the cooling trail is seen



An exhauster fan at the Hillsboro plant. One of these serves each furnace block. This unit is driven by a 150-hp. motor through a belt

of the packing house (8), where it passes through a series of rotary reel-type screening machines, and then through another series on the second floor which remove any grit that may have been carried along in the system.

The final operation, packing, takes place on the first floor of the packing house (8), where mechanical packers fill various types of shipping containers ranging from 50-lb. multi-walled paper bags and 300-lb. wooden barrels for the domestic trade to 110-, 220½-, and 224-lb. wooden barrels for export.

Storage facilities are provided in a brick-and-concrete warehouse (9), which is arranged for rail loading on one side and truck loading on the other.

At the Hillsboro plant, in Illinois, the operations of producing leaded zinc oxide are fundamentally the same as those just described, with the exception, as mentioned, that the production is confined to the manufacture of leaded zinc oxides. Obviously, the furnace charges contain calcined zinc concentrates of various lead content. Under certain conditions, it is desirable to use mixtures of leaded zinc and lead concentrates (galena), depending on the type of leaded zinc oxide produced.

No roasting is done at Hillsboro, inasmuch as the calcined concentrates are supplied by the East St. Louis plant.

In order that a complete line of zinc oxides can be offered to the trade, French process zinc oxide is also produced at Hillsboro, Ill. This operation consists of charging molten zinc metal into a battery of four retorts which are heated to volatilization temperatures by means of fuel-oil burners. The vapors oxidize at the mouth of the retorts with a bright, yellowish-blue flame. The zinc-oxide laden gases then pass through a cooling tube to a mechanical baghouse. Fifty-pound bags are then packed in the conventional manner.

Inasmuch as zinc oxide enjoys a wide variety of uses, it necessarily follows that many trade specifications must be met, which requires technical supervision of testing and plant operations.

The Azo-ZZZ brands of lead-free zinc oxides can be divided into two general classifications characterized by differences in particle structure. The acicular or needle-shaped particles (anisotropic) have been found to be very advantageous in paints because of superior weathering characteristics. This type is subdivided into several other grades according to oil absorption, consistency, and other factors. To a great extent these characteristics are dependent on particle size, shape, and distribution. The other type of zinc oxide is primarily used by the rubber trade, and consists of uniformly sized round (isotropic) particles, which measure about 0.22 microns.

Aside from daily microscopical observations of samples taken at frequent intervals, the technical staff examine the product for color analysis, texture, grit, hiding power, screen analysis, settling, consistency, oil absorption, and incorporation, rate of cure in rubber, tensile and modulus, aging, tear and abrasion resistance, flexing and chemical assay. Not only is a careful check made of the finished product, but raw materials and shipping containers must also meet certain physical and chemical specifications.

American Zinc, Lead & Smelting Company has a new process for the manufacture of pure zinc sulphide pigment under intensive development at the Columbus, Ohio, plant. At present it is on a semi-commercial scale of sufficient size to permit its introduction to the consuming trade for large-scale factory test. It is marketed under the trade name of "White Jack," an appropriate and descriptive designation that needs no explanation to the zinc-mining fraternity. The process and product are fully disclosed in United States Patents Nos. 2,006,259 and 2,074,210.

"White Jack" is produced from zinc sulphide concentrates in an operation that is completely cyclic. The precipitation of the zinc sulphide is accomplished by treating a purified zinc sulphate solution with a thiosulphate salt, and adding a base at a rate equivalent to the rate of reaction. Because of the novel method of precipitation, the "White Jack" process is also referred to as the "thiosulphate" process.

Considerable development remains before taking the next step of constructing a commercial plant with a large tonnage output. However, the product has already been extremely well received by the paint and rubber industries and is used in finished products so successfully that "White Jack" is considered as the outstanding improvement of recent years in a pure zinc sulphide pigment even before the development program is completed. The unusual characteristics of "White Jack" are its uniformity of particle structure and distribution, and an opacity and whitening strength not attained heretofore in zinc sulphide.

At the East St. Louis Smelter

(Continued from page 66)

sage to the employees. Departmental competition in making good safety records has helped to maintain interest.

All zinc-furnace men are examined monthly by a doctor. Men at the acid plant who handle lead are also examined monthly, and, in addition, blood tests are made regularly. Where it was thought a hazard might exist from injurious dusts, outside experts have been employed for dust-count surveys. Recommendations made as a result of the surveys have been carried out. The plant is plentifully equipped with goggles, respirators, and other safety clothing. Since the organization of the health and safety work, classes have been conducted in first aid. More than a majority of the men have completed these courses.

The graph on page 66 shows the marked reduction in lost-time injuries resulting from the safety campaign briefly outlined in the foregoing.

WASHINGTON OPERATIONS

A New Source of Ore In Washington

Metaline Mining & Leasing, controlled by American Zinc, is developing its property in Pend Oreille County.

D. I. Hayes
Western Manager
American Zinc, Lead & Smelting Company
Spokane, Wash.

METALINE MINING & Leasing Company is operating in Township 39 North, Range 43 E. W. M., in Pend Oreille County, Wash., where it has the mining rights to eight contiguous properties, which formerly were controlled by other corporations and individuals. The total holdings at present amount to about 1,145 acres. Generally speaking, the property contains and incloses the structural boundaries of several fault blocks of sedimentaries, including the outcrop for about 11,000 ft. along the strike and the continuation on the dip of a silicified dolomitic limestone that has rather definite possibilities of zinc-lead mineralization as replacement deposits. Along the east boundary of the property is a paved highway. The mining plant is adjacent to the highway and the Pend Oreille River and about 1 mile south of Metaline, 2½ miles south of Metaline Falls, 111 miles north of Spokane, and about a half mile west of the Metaline Falls branch of the Chicago, Milwaukee & St. Paul Pacific Railway.

Fifty-one per cent of the authorized stock of the Metaline Mining & Leasing Company is owned by the American Zinc, Lead & Smelting Company, which controls and manages all of the former company's activities.

The oldest major formation of the Metaline district is the quartzite, which outcrops in normal sequence on the east side of the district and again, by reason of upthrust faulting, on the west side of the district. Upward from the quartzite the formations are: shaly schist, alternating beds of limy dolomite and shale, the main lime-dolomite bed, and again shale. Fossils in the shale immediately beneath the main dolomitic formation are identified as Mid-Cambrian, and in the shale immediately above the main dolomitic bed as Mid-Ordovician. The Mid-Ordovician shale is the youngest fully consolidated sediment exposed in the district. Granite intrusives occur in the southwest corner of the district and extensively along the east side and bounding the quartzites in that direction.

The average width of the sedimentary exposures—excluding the quartzite—is approximately 6½ miles and the length from Ione north to the international boundary is 18 miles. Hence the district includes about 117 square miles of sedimentary exposures, with quartzite excluded. An estimated average dip across the district would indicate a thickness of 20,000 ft. for the schist, shale, and dolomitic beds. Due to faulting, this estimate is probably excessive, but the aggregate thickness is certainly in thousands of feet. Faulting is notably severe with both normal and reverse faults, and displacements are frequently over a thousand feet.

A cross-section of the topography shows quartzite mountains rising to 6,500 ft. above the sea on the east and west, and with the lower slopes frequently covered with the detritus from geologically recent mountain glaciation. At 2,500-ft. elevation are large remnants of a like bottom deposit of glacial silt through which the Pend Oreille River has cut a valley to a little below the 2,000-ft. elevation.

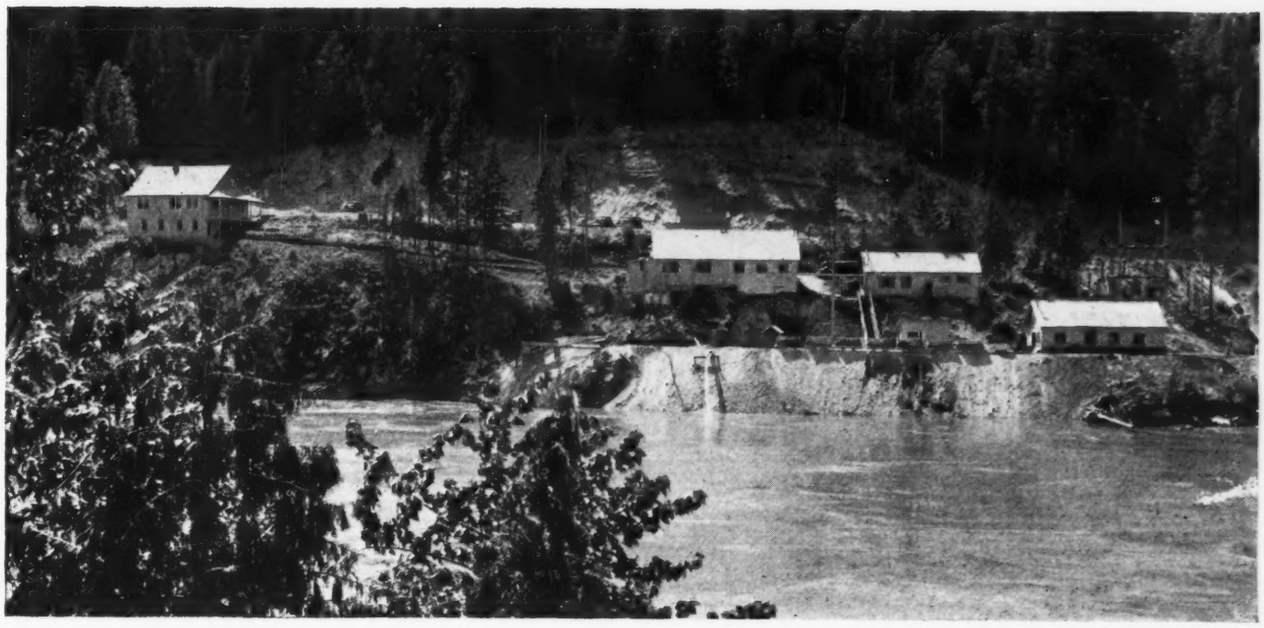
The zinc-lead deposits are confined to a few comparatively thin formations at certain horizons in the upper part of the main dolomitic bed. Mineral deposition was preceded by, and in lesser degree accompanied by, extensive silicification. The frequent zones of weakness and faulting were undoubtedly a considerable factor in the formation of orebodies.

It was early in July, 1933, that the American Zinc, Lead & Smelting Company took over the nucleus of the property described on a basis that has resulted in its present ownership of 51 per cent of the Metaline company stock. This nucleus consisted of about two-thirds of the present acreage controlled by the company. Beginning in July, 1933, and continuing until December, 1934, two and three surface diamond drills were operated continuously two and three shifts per 24-hour day. The purpose of this drilling was to locate and explore a certain horizon for zinc-lead mineralization. During this period 51 holes were drilled, totaling 25,747 ft., of which 2,812 ft. were in overburden and the rest in sedimentary rock. The cost of this drilling, based on the total footage, was $1.780 per foot, distributed as follows:

Labor	$1.282
Carbon loss	0.176
Gas and oil	0.124
Supplies, replacements, and miscellaneous equipment	0.198

The equipment consisted of three portable gasoline-engine-driven drills, equipped with E-rods and swivel-tube core barrels. The bits were hand-set, usually with both black carbon and bortz. Core recovery averaged 87 per cent. The formation drilled was much broken, causing frequent blocking of the core barrel, which made it necessary to pull the rods more often than not with less than three feet of core. The results of this initial exploratory drilling were such that it seemed advisable to follow up the drilling with underground exploration.

Whether to develop by shaft or by adit was considered. The latter was decided on as best fitting the situation,



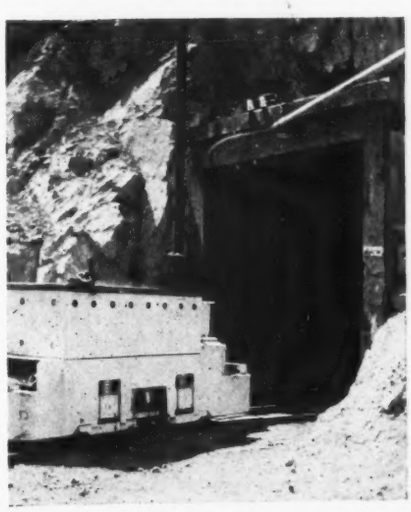
Surface plant and dump at tunnel portal from a point across the Pend Oreille River

both from the standpoint of probable cost and utility. Underground development was not started until the summer of 1936. A point was selected on the river bank between the State highway and the Pend Oreille River. The tunnel had to pass under the highway, so a site was chosen that would permit an adequate rock cover over the back of the tunnel under the highway. The initial plan was to drive the tunnel approximately 4,780 ft. to pass through and reach certain objectives that had been indicated by the drilling. The direction of the tunnel was changed at about 1,800 ft. from west to northwest to pass through or near certain areas. The tunnel has been driven approximately 5,650 ft. up to the present.

In cross-section, the tunnel is 8x8 ft. in the clear. This was considered the minimum size to accommodate the mechanical equipment that appeared to be best for getting the lowest cost per foot of advance. An effort was made to equip and organize for the work on a basis that would give the lowest cost per foot. Cost was not sacrificed for speed, but the speed factor, within limits of course, controlled to a great extent the unit cost of the work. The tunnel surface plant consisted of a 600-cu.ft. air compressor, a 175-hp. diesel engine, a 45-kva. alternating-current generator, a 3,000-6,000-cu.ft. ventilation blower, a pneumatic steel sharpener, an oil forge, and miscellaneous accessory equipment. The plant consisted of three buildings, one used as an engine room, another used as a combination change house and office, and the third as a blacksmith shop.

Grandview mill, 4½ miles from the tunnel portal. The plant has been rehabilitated by the Metaline company. Satisfactory test runs have been made on the ore thus far taken out

Portal of 5,650-ft. tunnel of Metaline Mining & Leasing Company. Dimensions in cross-section are 8x8 ft. in clear



Underground equipment consisted of three 3½-in. automatic feed drifters with accessories, one air-actuated mucking machine of the scraper type, one cherry picker hoist for car switching, fifteen 60-cu.ft. rocker-type dump cars, and two 5-ton storage-battery locomotives and other miscellaneous equipment.

After the work was organized, the tunnel was advanced on an average about 422 ft. a month, or 7.81 ft. per eight-hour shift. The crew consisted of six men on each of two shifts and two men on the third shift. This crew completed a cycle during the shift—that is, they drilled out the heading, shot it, loaded the muck, and disposed of it at the dump. In addition to this they did miscellaneous work, such as extending the air line, water line, Ventube, and track. The third shift of two men was called the clean-up shift, and did miscellaneous work, such as

completing track and pipe extensions and ditching that the regular shifts did not have time to do.

About 500 ft. of timbering was done in the tunnel through various fault zones. The total crew used in this work consisted of twenty men, including superintendent and engineer. The work of driving was done in a permanent manner—that is, no temporary track or piping was installed and a permanent water ditch was kept up to a point near the face at all times. Total cost of driving amounted to $23.58 a foot. This includes the cost of the plant, all equipment, all overhead expenses, and all expense incidental to the preliminary work in connection with driving.

Another view of the surface plant of the Metaline Mining & Leasing Company at the tunnel portal, showing the adjacent country

The work of driving the tunnel was discontinued temporarily when it had been advanced to the 4,782-ft. point. At that time miscellaneous development was started, such as raises, crosscuts, and underground drilling in two general sections that the tunnel had passed through. The purpose of this was to explore and develop mineralization known to exist in these localities. This work was done for about four months, when the company officials decided that it would be advisable to begin to open up stopes in several places where mineralization had been encountered. The first ore was taken from the tunnel about Nov. 1, 1937. At the beginning, about 100 tons a day was taken. This was increased to about 240 tons a day by March 31, 1938, when all ore extraction work was discontinued due to the situation of low metal prices that had developed in the meantime. A considerable amount of work remains to be done before the property is developed to a point where production can be maintained properly. From March 31 to date this development work has been in progress with a small crew.

During the summer of 1937 a power line was constructed, which made available at the tunnel plant power generated at the Pend Oreille Mines & Metals Company's new hydro-electric plant on the Pend Oreille River. A 1,500-cu.ft. compressor was installed, driven by a 300-hp. synchronous motor. Considerable underground equipment was added, and there is now enough for producing ore at the rate of about 350 tons a day when the property is sufficiently developed for that rate of production.

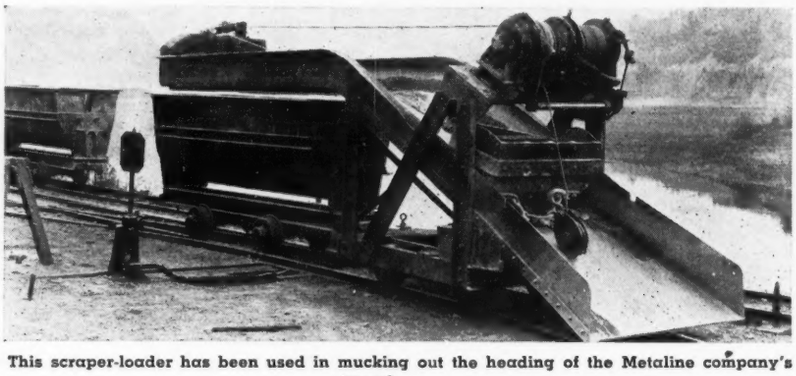
About 7,240 ft. of underground diamond drilling has been done since the initial tunnel work was completed. This was accomplished with a small, standard, air-actuated drilling machine equipped with standard 5-ft. E-rods, a swivel-tube core barrel, and a pneumatic rod puller. The first underground drilling done was quite costly and drilling costs have gradually been reduced until in the last few months the work was being done for less than 95c. a foot, exclusive of power cost. Of this total cost, 23c. would be the carbon and bit cost and the remaining would cover labor, supplies, and repairs.

During 1936 the American Zinc, Lead & Smelting Company acquired an option to purchase the Grandview mill and a lease on the Grandview mining property. The mill and property are situated about 2 miles north of Metaline Falls, or 4½ miles from the Metaline company's tunnel portal. The mill is close to the same paved State highway that passes the portal. Development ore taken from the tunnel from November, 1937, to March 31, 1938, was trucked from bins at the tunnel to the mill.

The Grandview mill, built by Grandview Mines, Inc., about 1928, has two main buildings, a crusher house and a concentrator, connected by a belt conveyor. These are of steel construction with double galvanized-iron sheeting. The principal equipment in the crusher house is an 8K gyratory crusher and a pair of 54x20-in. rolls; that in the concentrator is an 8x6-ft. ball mill, twenty cells of mechanical flotation equipment with 24-in. impellers, and other accessory equipment.

When the mill was taken over, it had not been operated for several years. About $20,000 was spent in rehabilitating it and adding equipment that was thought necessary to enable the plant to be used for pilot purposes to determine the best method of concentrating the ores derived from the tunnel development. The plant did good work. Tests indicate that with the addition of a comparatively small amount of equipment about 93 per cent of the sulphide zinc will be recovered in a zinc concentrate assaying about 62 per cent zinc, and 90 per cent plus of the lead in a concentrate assaying 75 per cent lead.

Insufficient work has been done on the property to determine accurately what the grade of ore or the operating cost is going to be. It appears likely that the latter, when the mill is handling not less than 10,000 tons per month, will be under $3 a ton. This would include all expense for mining and development, trucking and concentration, and overhead and general expense items, except Federal income taxes, depreciation, and depletion.



This scraper-loader has been used in mucking out the heading of the Metaline company's tunnel

A substantial part of the information in this article was compiled and furnished by R. E. Calhoun, superintendent; H. F. Mills, engineer and geologist; and C. C. Martin, mill superintendent.

PERSONAL ITEMS

Dr. J. A. Dunn, of the Geological Survey of India, is on a holiday visit to Melbourne.

R. A. Whear has been appointed assistant mining engineer to the Southern Rhodesian Government.

Edward Wisser, consulting geologist for Consolidated Mines, Inc., Manila, P. I., has returned to Berkeley, Calif.

H. E. Wheelock, consulting engineer, has left Maguarichic, Chihuahua, Mexico, and is at Missouri Valley, Iowa.

Frank Ayer, general manager, Roan Antelope Copper Mines, Ltd., recently returned to Rhodesia after a visit to the United States.

John B. Knaebel, consulting mining engineer, has returned to his headquarters in San Francisco from a professional trip to Mexico.

E. G. Banks has left Melbourne, Australia, for Tennant Creek, where he will examine gold-mining properties in which he is interested.

Donald M. Ray has returned to Des Moines, Iowa., from Morococha, Peru, where he was mill foreman for Cerro de Pasco Copper Corporation.

Harry Middlebrook, mining engineer, of Crosby, Minn., is now employed by the Black Rock Mining Company at the Alice iron mine, at Eveleth, Minn.

J. MacGregor, consulting engineer, has been engaged by Wiltsey-Coghlan Mines to examine its property, which adjoins Waite Amulet at Noranda, Quebec.

W. H. Coghill, metallurgist, United States Bureau of Mines, Rolla, Mo., is now at the Southern Experiment Station, University of Alabama, Tuscaloosa, Ala.

Fred Flink, of Coleraine, Minn., is now superintendent of the Judd iron mine of the Charleson Iron Mining Company at Bovey, Minn., succeeding the late W. W. Schwarz.

W. Holford, mill superintendent of Central Norseman Gold Corporation, Norseman, W. A., has joined Mount Morgan, Ltd., as superintendent of the oxidized ore treatment plant.

T. S. Mackay is acting as general manager of Big Bell Mines, Ltd., operating at Cue, in the Murchison district, Western Australia, during the absence of **Dale Pitt,** who arrived in New York on July 25.

John S. Stewart, metallurgical engineer, has returned to London in the interest of Trepca Mines, Ltd., Selection Trust Building, Masons Ave., Coleman St., London E. C. 2, England.

Gustav A. Dahlke, Jr., mining engineer, until recently with Cia. Minera de Narino, Barbacos, Colombia, S. A., has joined the staff of Empire Star Mines Company, Ltd., Grass Valley, Calif.

Edward C. Barringer, of Cleveland, Ohio, editor of *Daily Metal Trade,* of that city, has been made executive secretary of the Institute of Scrap Iron & Steel, Inc., succeeding **Benjamin Schwarz.**

H. H. Read, Herdman professor of geology at the University of Liverpool, has been appointed professor of geology in the Imperial College in succession to **Professor C. H. Boswell,** who is retiring.

George H. Cunningham, consulting engineer, returned to New York the first of July from a business trip to Peru, South America, for the Cerro de Pasco Copper Corporation, in connection with that company's zinc development.

Robert S. Moehlman has been transferred from the Butte office of the Anaconda Copper Mining Company to the office of the company at Inspiration, Ariz. At Butte he was geologist for the Leonard and Mountain Consolidated mines.

W. Frank Crowley, general manager of the New Deal Gold Mining & Milling Company, operating the Ajax mine and mill, in the Arivaca mining district, Pima County, Ariz., has announced his intention to run for Congress.

T. M. Carey, chief engineer of The Zinc Corporation, Ltd., Broken Hill, Australia, left at the end of May for the United States on the first stage of a world tour of mining and metallurgical plants. He intends to return to Australia in February.

Charles E. Basso has resigned all official positions with the mining companies with which he has been associated, and will devote his time to consulting work. He has announced his candidacy for the elective office of State Mine Inspector for Nevada.

W. R. Appleby, dean of the school of mines of the University of Minnesota, at Minneapolis, has retired as the head of the mining school. He opened the school of mines at the University in 1891 and had been head of the institution since that time.

F. G. Forman, Government Geologist of Western Australia, has been awarded a fellowship of the Commonwealth Fund of New York, and intends to spend twelve months at Harvard on research into structural geology in relation to gold deposition.

Carl J. Trauerman, mining engineer, Butte, Mont., has disposed of his interest in the Montana Stock & Bond Company to his associate, and will devote his time to the operation of mining companies with which he is connected. Mr. Trauerman is president of the Mining Association of Montana.

Blair W. Stewart, who was reported in the personal items pages of the July issue of *Engineering & Mining Journal* to have severed his connection with Basin Montana Tunnel Company, still retains his position of chief geologist for the company. He is at Sevier, Utah, only temporarily, conducting an examination of the old Annie Laurie mine.

W. J. Loring has made several trips to California recently to investigate the possibilities of a shoveling operation to recover gold ore at the surface of several mining claims that show a considerable tonnage of payable ore. Arizona Comstock Corporation is to be reorganized and financed to carry on a program that has been under consideration for some time.

Don F. Johnson, of Colorado, who recently returned from Peru, where he was concentrator foreman for Cerro de Pasco Copper Company, has been named mill foreman for the International Vanadian Corporation, operating properties in the Dripping Springs district near Globe, Ariz. Victor Otto is manager for the company.

R. L. Kidd, ore-dressing engineer, Engineering Experiment Station, University of Utah, is taking a year's leave of absence to visit mills throughout the country. During his absence the work in ore dressing will be handled by **Carl M. Dice,** formerly assistant professor of metallurgy and for the past five years research metallurgist at the Midvale plant of the United States Smelting, Refining & Mining Company.

Dr. Colin J. Smithells, of the research laboratories of the General Electric Company, Ltd., of England, will address the October meeting of the Notre Dame chapter of the American Society of Metals, on Oct. 14, 1938. His subject will be "Powder Metallurgy: The Structure of Sintered Metals and Alloys." Dr. Smithells will deliver the autumn lecture to the Institute of Metals in Detroit in the following week.

Wendell W. Fertig, consulting mining engineer, with offices in Manila, P. I., has accepted the position of general superintendent, Santa Rosa Mining Company, Paracale district, Philippine Islands. Santa Rosa is milling 200 tons of copper-gold ore daily in the company's new flotation plant, and expected to place the cyanide plant, for treating flotation tails, in operation the middle of July. Mr. Fertig acts as mining consultant for Acoje Mining Company, the second largest producer of high-grade chromite in the islands, and for Philippine Copper Mines, Inc., which is shipping crude copper ore to Japan.

W. Val De Camp, general manager of mines for M. Hochschild in Bolivia, announces the following changes in staff: **J. Daume** has been appointed mine superintendent for the Huanchaca Company at Pulacayo; **P. H. Reagan,** former mine superintendent, has been transferred to Oruro in connection with the operations of Compañia

Minera De Oruro; **V. Hampton,** formerly assistant mine superintendent at Patiño mines, has been appointed manager of the San José mine, at Oruro, and has engaged **H. B. Leggett** as geologist; **G. Hawn, M. H. Keegan,** and **J. Kirig** as mine foremen, and **Mr. De Wys** as administrator of the Itos mine. At the Colquiri mine of the C.M.O., **O. D. Neidermeyer** has been appointed mine manager; **J. Randall,** mine superintendent; **G. N. McCrae,** mill construction superintendent; **G. M. Kirwan,** mine engineer; and **K. J. Bell** and **L. Pommerolli** have been made shift foremen. At the Morococala mine of the C.M.O., **Mr. van Blom** has been appointed mine manager and **Kai Ravenborg,** administrator at the Vinto plant, has been transferred to Machacamarca.

▼ ▼ ▼

OBITUARY

John Byrnes Lane, mining engineer, of Reno, Nev., died on June 30 at the age of 53.

Robert F. Bunting, a Canadian mining man and president of the Black Donald Graphite Mining Company, at Calabogie, Ont., died at Renfrew, Ont., on July 16 at the age of 72.

John Till, a well-known mine manager of Victoria, died at Warrandyte, near Melbourne, on June 16. Mr. Till had been connected with the industry for 45 years as a manager, and for the past five years had been mine manager of Wattle Gully Gold Mines, N. L., Chewton, Australia.

J. W. Bennie, a mining man at one time widely known throughout the Southwest, died in London, England, on July 16 at the age of 72. Mr. Bennie was formerly manager of Shannon Copper Company and Arizona Copper Company, at Clifton, Ariz.

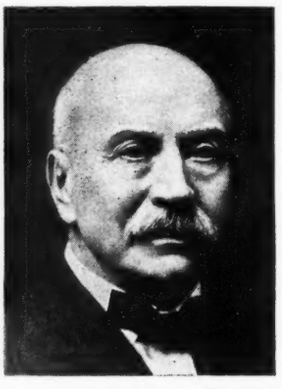
Herman E. Van Thijn, 38, a mining engineer of Los Angeles, was found dead from thirst in Death Valley, Calif., on July 19. He had set out with Robert L. Wicks for Owl Hole Springs, near Shoshone, to inspect mining properties. When their auto stalled deep in the Mojave desert, Van Thijn and Wicks started on foot in search of water. Van Thijn collapsed, and Wicks, after carrying him to a patch of greasewood, resumed his efforts to find Owl Hole. On his return with a posse, Van Thijn's body was found 300 yards from the patch of wood in which he had sought shelter.

Frederick Young Robertson, vice-president and for many years manager of metal sales of the United States Smelting, Refining & Mining Company, died at Southfield Point, Stamford, Conn., on July 12, at the age of 80. Mr. Robertson was born at Unionville (now Morrison), Ill., and while still in his 'teens settled in Kearney, Neb., where he organized a local bank, which failed in the panic of 1893. He then came to New York, and after a brief experience as a bond clerk became interested in silver, copper, and oil. He also became an expert metallurgist, and amassed a considerable fortune, much of which was devoted to private charitable contributions. Though self-educated, he sent a score or so of his relatives and friends through college. He had been at times a director of more than thirty mining and metals enterprises and at the time of his death was on the board of the Niagara Mining Company, Richmond-Eureka Mining Company, U. S. S. Lead Refinery, Inc., and the United

FREDERICK YOUNG ROBERTSON

States Metals Refining Company. Mr. Robertson was a member of the A.I.M.E. He is survived by his widow, Evelyn Rachel Anderson Robertson.

Colonel Henry Clay Rizer, for 34 years chief clerk of the United States Geological Survey and known widely by mining men, died in Washington on July 20 at the age of 94. By executive order he had continued in office until he was 81. He served throughout the



COLONEL HENRY CLAY RIZER

Civil War in the Union army and attained the rank of colonel before he was 21. Colonel Rizer's practice of walking three miles each day was continued until three weeks before his death.

John L. W. Birkinbine, mining and railroad engineer, who had distinguished himself by professional work in Mexico, died in Philadelphia on July 17 at the age of 61.

William Robertson, who was manager of the Broken Hill Smelters at Port Pirie, S. A., for many years, died recently in Adelaide, aged 70 years.

Thomas Blatchford, Government Geologist of Western Australia from 1928 to 1934, died at Roebourne, W. A., on May 28 aged 69 years. Mr. Blatchford had been engaged in consulting work since retiring from the survey.

William J. Sharwood, metallurgical engineer, died at Berkeley, Calif., on July 4 at the age of 71. He was born in Tuolumne, Calif., and a graduate of the Royal School of Mines, London, England. After his graduation, Mr. Sharwood was employed at various gold mines in California, following which he joined the faculty of the University of California as instructor in chemistry. Later he was chemist with the Montana Mining Company at Marysville, Mont., and Homestake Mining Company, Lead, S. D. He contributed numerous papers on analytical chemistry, assaying, metallurgy of gold, and economic geology. He was a member of A.I.M.E., Institute Mining and Metallurgy, American Chemical Society, Society Chemical Industry, and Fellow of A.A.A.S.

▼ ▼ ▼

Letters

Valuation of Mines and Prospects

The Editor:

I HAVE READ with considerable interest Harrison Schmitt's article on "Valuation of Mines and Prospects" in the March, 1938, issue of *Engineering and Mining Journal.* He expresses in very clear English a number of sound principles of mine examination and lists much valuable information.

The only thing in the article to which I can take exception is his statement that "for large orebodies at shallow depth where the ground is not too hard, churn drilling appears to be the best means of exploration, as, for example, in 'porphyry' deposits."

In my opinion, there is no question that diamond drilling for "porphyry" coppers is superior to churn drilling if both drilling crew and engineering department pay the proper attention to securing correct sludge samples. Proper attention to sludge samples in "porphyry" copper drilling means:

1. Having a sampler on each shift in addition to the drill crew.
2. Proper cooperation between drill crew and sampler, keeping in mind the requirements of both sampling and drilling technique.
3. Collecting all of the return water in barrels or tanks.
4. Measuring the amount of return water against the water pumped into the hole and endeavoring to secure, so far as possible, at least a 90 per cent water recovery.
5. Careful decanting of the clear water from the sludge settling tanks and careful drying and quartering of the sludge.
6. Separate assaying of core and sludge.
7. Proper combining of the assays to determine final accepted assay.

This program is really very simple but apparently is understood by few engineers and drill men. If the procedure mentioned is not taken in drilling

"Mining in the Philippines"

Mr. Keeler Replies to the Observations of Quirico A. Abadilla, Director Of the Philippines Bureau of Mines, as Presented in the June Issue of *E.&M.J.*

The Editor

ENCLOSED HEREWITH a copy of the reply which I sent to Mr. Quirico A. Abadilla, Director of the Bureau of Mines of the Philippines, in answer to his criticism of my article in the February, 1938, issue of the *Engineering and Mining Journal*, "The Philippines." I request that my letter, in part or in full, be published to state my side of the question.

RALPH KEELER

Manila, Philippine Islands,
July 19, 1938

April 21, 1938

Hon. Quirico Abadilla,
Director of the Bureau of Mines,
Manila.

Dear Mr. Abadilla:

I have read with care your letter of April 1st.

You asked to be enlightened as to what Government interference is feared by the mining companies, and state that you are not aware of a plan of the Government to interfere with their operation.

I call your attention to the Provisions of Section 3 (MNO), and of Section 6 of Act 136, as well as Section 77 of the Mining Law which empowers your office, with the approval of the Secretary of Agriculture and Commerce, to prescribe rules and regulations for the policing and sanitation of mines, easements, drainage, disposal of waste or tailings, water-rights, right of way, right of Government survey and inspection and other necessary means, to their economic utilization, as well as such rules for the purpose of insuring the exercise of reasonable diligence, skill, and care in mining operations.

It will seem obvious that these powers are such as to enable your office to interfere with the operation and management of mining properties. Wherever your judgment does not agree with that of the owner as to how the property should be managed, your judgment prevails. That, in my opinion, constitutes such interference either actual or potential justifying the "fear" I mentioned in my article. In this connection, I might say that you have but to ask the average mining executive in the Philippines as to his frame of mind about the matter and you will find that my statement is fully justified.

You criticize my statement that the Government is empowered to increase taxes at will and to cancel any or all leases for real or fancied violation of any provisional law or to impose any regulation whatsoever.

As a matter of fact, the law authorizes the administrative cancellation of the lease not only for the violation of any provision of the law, but of any provision of the lease, which you draft, or of your regulations. I am advised that an earnest effort was made by the Chamber of Mines to compel the Government to recourse to the courts before cancellation, and that this was resisted by your office, you insisting upon the reservation of the right to cancel by administrative action. I call your attention to the provisions of Section 84 of the Mining Law on the point. The elimination of the word "of" in that section was opposed by your office.

I believe that your refusal to subject the question of cancellation to judicial test justifies me in using the word "fancied." It is certain that the provisions of the law as to cancellation are far too rigid and far reaching to inspire confidence and to warrant extended investment in mining claims held under lease. If any violation of any provision of the law or any regulation or any provision of the contract, however trivial, authorizes you to cancel the lease as the law provides it would be easy, as you can see, to trump up charges of such violations in an operation as complicated as that of the operation especially where the property has been shown to be valuable. The investor simply would not dare to risk his money under such circumstances.

You criticize my statement that many men feel that the Government would do all it can to prevent the granting of leases to American or foreign locators. In connection with this statement I am advised that you now have 100 lease applications pending in your office and that since the passage of the mining law you have granted only 6 leases, not one of them for a gold mining property. It does not seem unreasonable to state that the Government is reluctant, to say the least, to grant any leases to anybody. When it is remembered that under the law as finally enacted commercial operation is prohibited until the lease is granted, you will see that the provisions of the law operate to strangle any real expansion of the industry.

You criticize me for stating that many applications for patents were made, but that the final granting had been deliberately delayed and you say that this statement is not true. I call your attention to the answer of the Government in test cases now pending to the effect, that the President ordered on or about Sept. 24, 1936, that thereafter 'No patent be issued to any mining claim regardless of the fact that the claimant had already complied with all the requirements of the law in the matter prior to the inauguration of the Commonwealth.'

I am also reliably informed that administrative instructions were given to slow up the granting of patents before the inauguration of the Commonwealth. In this connection it will be interesting to learn how many patent applications were pending at the inauguration of the Commonwealth, the dates on which such applications were filed, and the reasons why these patents had not been granted at that time. It is the general impression among mining men in the Philippines that for a period of two to three years prior to the inauguration of the Commonwealth it was practically impossible to secure a patent on mining claims. The facts in the case seem to justify this feeling.

Your characterization of my statement that the Government is empowered to impose any regulation whatsoever, as "unfair and malicious" would seem to be without foundation in view of the provisions of Section 84 of the Mining Law. As a practical matter you must know that because of the sweeping provisions of that section it would be practically impossible to set aside any regulation your office might see fit to adopt.

You criticize my statement that the attitude of the Commonwealth Government during the first period was anything but sympathetic. I refer you (1) to the position taken by the Collector of Internal Revenue wherein he claims the right to review the computation of the output tax of past years and, where mines produce other metals as well as gold, to impose a tax upon the whole output as though it were all gold; (2) to the attitude of the securities commission in imposing all sorts of restrictions in connection with the issuance of stock for the purpose of organizing mining companies; (3) to the attitude of your office in connection with the valuation of mining properties. I am advised that you placed a valuation of 115,000 pesos upon the property of Mindanao Mother Lode, whereas this property produced 600,000 pesos in bullion during the first three months of its operation. There are other examples of similar nature which could be cited. It certainly does seem that the attitude of Government offices in general having to do with the mining industry has been such as to justify the fears mentioned in my article.

You speak reprovingly of "recalcitrant individuals" and intimate that those who criticize the policy of the Government, as embodied in the law and in its administration by the various Government Offices, should be subject to discriminatory treatment. That statement implies that the Government should endeavor to discourage mining in this country by individuals either foreign or local who see anything of ill-omen in any act of the Government. I trust that you do not mean to say that those who criticize the legislation which has been enacted, or any regulations or administrative action which has been taken would be subject to discriminatory treatment at the hands of your office or any other office having to do with the administration of the law.

I am sure that you understand that there is no malice of any kind intended in my article. As the Philippine Correspondent of the Engineering and Mining Journal it is my duty to report the situation as I see it. The article to which you object was carefully prepared after consultation with men whose experience and whose position make their opinions authoritative.

Very truly yours, RALPH KEELER

---

low-grade disseminated deposits, diamond-drill results can be very misleading. If they are properly carried out, results can be achieved as at Ajo, Ariz., where the recovery in mining has checked the values shown by diamond drilling so closely that for practical purposes it can be considered a 100 per cent check.

R. D. LONGYEAR

Minneapolis, Minn.

Summary of the

MARKETS

THE month of July was marked by higher prices for all of the major non-ferrous metals. Buying continued on a substantial scale, particularly in copper, and news from consuming centers indicated that the trend in actual use of metals was definitely upward. Evidence of the improvement in conditions throughout industry was seen in the higher rate of activity in the steel industry, which increased operations to 39.8 per cent as July ended, against 22.4 per cent at the beginning of the month.

The *E.&M.J.* index of non-ferrous metal prices advanced from 67.55 in June to 72.95 for July. Since the close of June the domestic quotation for copper advanced 1⅛c.; lead was raised 15 points; zinc, 25 points; and tin, 1¼c. Lower prices prevailed for antimony (domestic), quicksilver, manganese ore, and chrome ore. Tungsten ore remained more or less nominal because of continued uncertainty over the situation in China.

Domestic sales of copper for July totaled 124,504 tons, the highest tonnage booked monthly since October, 1936. Out of the total quantity sold during the month, about 108,000 tons was for October shipment to consumers. The advance in the price from 9¾c. to 10⅛c. was far more orderly than the initial moves to raise the quotation. The upward trend here again followed London, but there was no fear of a repetition of the bull market of 1936-1937. Leading producers already have taken steps to expand production. The June statistics were better than expected, domestic stocks of refined decreasing by 10,838 tons.

Owing to a downward revision of the Atlantic freight rate, our differential on export business has been lowered to 0.325c., effective July 1.

Consumption of lead has increased in this country in the last month sufficiently to impart a strong tone to the market. Both lead and zinc prices in this country were held in check late in July because of the lagging London quotations.

UNITED STATES MARKET

1938	Electrolytic Copper Domestic (a)	Electrolytic Copper Export (b)	Straits Tin New York	Lead New York	Lead St. Louis	Zinc St. Louis
July						
1	9.275	9.200	43.125	4.75	4.60	4.50 @ 4.75
2	9.275	9.250	44.000	4.75	4.60	4.75
4	Holiday	9.250	Holiday	Holiday	Holiday	Holiday
5	9.525	9.625	43.500	4.75	4.60	4.75
6	9.525	9.625	43.500	4.90	4.75	4.75
7	9.525	9.625	43.800	4.90	4.75	4.75
8	9.525	9.275	42.700	4.90	4.75	4.75
9	9.525	9.300	42.750	4.90	4.75	4.75
11	9.525	9.300	42.750	4.90	4.75	4.75
12	9.525	9.250	42.750	4.90	4.75	4.75
13	9.525	9.350	43.650	4.90	4.75	4.75
14	9.525	9.350	42.975	4.90	4.75	4.75
15	9.525	9.400	43.200	4.90	4.75	4.75
16	9.525	9.450	43.150	4.90	4.75	4.75
18	9.525	9.525	43.125	4.90	4.75	4.75
19	9.525	9.575	43.350	4.90	4.75	4.75
20	9.525	9.650	43.500	4.90	4.75	4.75
21	9.525	9.625	43.500	4.90	4.75	4.75
22	9.650	9.700	43.500	4.90	4.75	4.75
23	9.650	9.775	43.625	4.90	4.75	4.75
25	9.775	9.875	43.750	4.90	4.75	4.75
26	9.775	9.975	43.750	4.90	4.75	4.75
27	9.775	10.025	43.750	4.90	4.75	4.75
28	9.775	9.925	43.500	4.90	4.75	4.75
29	9.900	9.975	44.250	4.90	4.75	4.75
30	9.900	10.025	44.250	4.90	4.75	4.75
Average for Month	9.585	9.573	43.428	4.882	4.732	4.745
July		**AVERAGES FOR WEEK**				
6	9.275	9.333	43.425	4.780	4.630	4.675
13	9.525	9.350	43.067	4.900	4.750	4.750
20	9.525	9.492	43.217	4.900	4.750	4.750
27	9.692	9.829	43.646	4.900	4.750	4.750
July		**CALENDAR WEEK AVERAGES**				
2	8.942	9.075	42.938	4.625	4.475	4.563
9	9.525	9.450	43.250	4.870	4.720	4.750
16	9.525	9.350	43.079	4.900	4.750	4.750
23	9.567	9.642	43.433	4.900	4.750	4.750
30	9.817	9.967	43.875	4.900	4.750	4.750

SILVER, GOLD, AND STERLING EXCHANGE

NEW YORK AND LONDON

1938	Sterling Exchange "Checks"	Sterling Exchange "90-day demand"	Silver (c) New York	Silver London	Gold London	Gold (d) United States
July						
1	4.955000	4.948750	42.750	18.9375	140s 9d	$35.00
2	4.955000	4.949375	(e)	19.0000	140s 9d	35.00
4	Holiday	Holiday	Holiday	19.1250	140s 9½d	Holiday
5	4.951250	4.945625	42.750	19.2500	140s 8½d	35.00
6	4.940000	4.934375	42.750	19.1875	140s 11d	35.00
7	4.935625	4.930625	42.750	19.1875	141s 1½d	35.00
8	4.940625	4.934375	42.750	19.2500	141s 1½d	35.00
9	4.936250	4.930625	(e)	19.3125	141s 1½d	35.00
11	4.927500	4.921250	42.750	19.3125	141s 2d	35.00
12	4.925625	4.920000	42.750	19.3750	141s 2½d	35.00
13	4.930000	4.924375	42.750	19.3750	141s 2½d	35.00
14	4.928750	4.922500	42.750	19.3125	141s 2d	35.00
15	4.931250	4.924375	42.750	19.3750	141s 2d	35.00
16	4.926250	4.920000	(e)	19.3125	141s 2½d	35.00
18	4.922500	4.916250	42.750	19.3125	141s 3d	35.00
19	4.916875	4.910000	42.750	19.5000	141s 4½d	35.00
20	4.919375	4.912500	42.750	19.5625	141s 6d	35.00
21	4.915000	4.908125	42.750	19.5000	141s 5½d	35.00
22	4.918125	4.911250	42.750	19.5000	141s 5½d	35.00
23	4.921250	4.914375	(e)	19.6250	141s 5d	35.00
25	4.920000	4.913125	42.750	19.8125	141s 5d	35.00
26	4.925625	4.918750	42.750	19.6250	141s 4d	35.00
27	4.923125	4.916250	42.750	19.4375	141s 4d	35.00
28	4.918750	4.911875	42.750	19.3125	141s 5d	35.00
29	4.912500	4.905625	42.750	19.3750	141s 6½d	35.00
30	4.917500	4.910625	(e)	19.3750	141s 6d	35.00
Average for Month	4.92855	.....	42.750	19.356	.....	35.00
July		**AVERAGES FOR WEEK**				
6	4.95100	.....	42.750	.....	.....	.....
13	4.93260	.....	42.750	.....	.....	.....
20	4.92417	.....	42.750	.....	.....	.....
27	4.92052	.....	42.750	.....	.....	.....

Calendar week averages: New York Silver July 2nd, 42.750; 9th, 42.750; 16th, 42.750; 23rd, 42.750; 30th, 42.750.

(e) Not quoted; Saturday.

THE above quotations for major non-ferrous metals are our appraisal of the important United States markets, based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis, as noted. All prices are in cents per pound.

(a) Net prices at refineries on Atlantic seaboard. To arrive at the delivered New England basis add 0.225c. per pound, the average differential for freight and delivery charges.

(b) Export prices are net at refineries on the Atlantic seaboard and include sales of domestic copper in the foreign market. Most sales in the foreign market are made on the basis of c.i.f. usual ports of destination—Hamburg, Havre, and Liverpool. The c.i.f. basis commands a premium of 0.325c. per pound above our refinery quotation.

Copper, lead and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

Quotations for copper are for the ordinary forms of wirebars and ingot bars; cathodes are sold at a discount of 0.125c.

Quotations for zinc are for ordinary Prime Western brands. Zinc in New York commands a premium over the St. Louis basis equal to the freight differential. Contract prices for High Grade zinc delivered in the East and Middle West in nearly all instances command a premium of 1c. per pound over the current market for Prime Western but not less than 1c. over the *Engineering and Mining Journal's* average quotation for Prime Western for the previous month.

Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

(c) Silver other than newly mined domestic. Under Executive order effective Jan. 1, 1938, the U. S. Government's price on newly mined domestic silver was established at 64.64c. Handy & Harman's quotation for domestic silver, 999 fine, was 64⅛c. per ounce throughout July.

(d) U. S. Treasury's gold price. Actual payment by the United States Treasury for gold in domestic and imported ore or concentrate is at 99.75 per cent of the price quotated by the Treasury, which at present is equal to $34.9125 per ounce.

PRICES OF METALS • MISCELLANEOUS QUOTATIONS

LONDON MARKET

1938 July	COPPER Standard Spot	COPPER Standard 3 months	COPPER Electro Bid	TIN Standard Spot	TIN Standard 3 months	LEAD Spot Buyers	LEAD Spot Sellers	LEAD 3 months Buyers	LEAD 3 months Sellers	ZINC Spot Buyers	ZINC Spot Sellers	ZINC 3 months Buyers	ZINC 3 months Sellers
1.....	38.0625	38.3750	42.2500	188.1250	189.1250	15.0625	15.1250	15.1875	15.2500	14.2500	14.3125	14.5000	14.5625
4.....	39.5625	39.8750	44.0000	194.0000	195.2500	14.9375	15.0000	15.0625	15.1250	14.1875	14.2500	14.4375	14.5000
5.....	40.1250	40.3750	44.2500	194.0000	195.2500	15.2500	15.3125	15.4375	15.5000	14.4375	14.5000	14.6875	14.7500
6.....	39.8125	40.1250	44.2500	193.2500	194.5000	15.3125	15.3750	15.4375	15.5000	14.3750	14.5000	14.6875	14.7500
7.....	39.6875	40.0000	44.2500	193.7500	195.0000	15.4375	15.5000	15.5625	15.6250	14.3750	14.4375	14.6250	14.6875
8.....	38.3125	38.6250	43.0000	189.0000	190.2500	14.8125	14.8750	15.0000	15.0625	13.7500	13.8125	13.9375	14.0625
11.....	38.7500	39.0000	43.0000	189.6250	190.7500	14.8125	14.8750	15.0000	15.0625	14.0000	14.1250	14.1875	14.3125
12.....	37.9375	38.2500	42.5000	189.0000	190.0000	14.5000	14.5625	14.6875	14.7500	13.6250	13.6875	13.8750	13.9375
13.....	38.8750	39.1875	44.0000	192.5000	193.7500	14.9375	15.0000	15.1250	15.1875	14.2500	14.3125	14.5000	14.5625
14.....	38.5000	38.8125	43.0000	190.2500	191.5000	14.5625	14.6250	14.6875	14.7500	13.9375	14.0625	14.1875	14.2500
15.....	38.9375	39.2500	43.5000	191.0000	192.2500	14.6875	14.7500	14.8125	14.8750	13.9375	14.0625	14.1875	14.2500
18.....	39.6875	40.0000	44.0000	192.2500	193.5000	14.6250	14.7500	14.8125	14.8750	14.1250	14.1875	14.3750	14.4375
19.....	39.9375	40.2500	44.2500	193.0000	194.0000	14.6875	14.7500	14.7500	14.8125	14.1250	14.1875	14.3125	14.4375
20.....	40.1875	40.5000	45.2500	194.2500	195.5000	14.6875	14.7500	14.8125	14.8750	14.1875	14.2500	14.3750	14.5000
21.....	39.8125	40.1875	44.5000	193.7500	194.7500	14.5000	14.5625	14.5625	14.6250	14.0625	14.1250	14.2500	14.3125
22.....	40.4375	40.6875	45.0000	194.0000	195.0000	14.6250	14.6875	14.6875	14.7500	14.0000	14.0625	14.2500	14.3125
25.....	41.1875	41.4375	45.7500	194.7500	195.7500	14.9375	15.0625	15.0625	15.1250	14.3125	14.3750	14.5625	14.6250
26.....	41.2500	41.5000	46.5000	194.3750	195.2500	15.1250	15.2500	15.1875	15.2500	14.1875	14.2500	14.3750	14.4375
27.....	41.5625	41.8125	46.5000	194.0000	195.2500	15.3125	15.3750	15.3750	15.4375	14.1875	14.2500	14.3750	14.4375
28.....	40.6875	40.9375	46.5000	192.7500	194.0000	14.7500	14.8125	14.8125	14.8750	13.9375	14.0000	14.1250	14.1875
29.....	41.3125	41.6250	46.2500	195.7500	197.0000	15.0000	15.1250	15.0000	15.0625	14.0000	14.0625	14.1875	14.2500
Average for month..	39.744	.....	44.405	192.542	.....	14.921		15.034		14.144		14.371	

Prices for lead and zinc are the official prices for the first session of the London Metal Exchange; prices for copper and tin are the official closing buyers' prices. All are in pounds sterling per long ton of 2,240 lb.

CURRENT PRICES — MISCELLANEOUS METALS, ORES, AND NON-METALLIC MINERALS

Quotations cover wholesale lots, prompt shipment, f.o.b. New York, unless otherwise stated
(Aug. 1, 1938)

MISCELLANEOUS METALS

Aluminum, ingot, 99 plus per cent, lb	20c.
Antimony, domestic, spot, lb	10.75c
Bismuth, ton lots, lb	$1.05
Cadmium, lb	85c. @$1.20
Calcium, lb., ton lots 98 @ 99 per cent	75c.
Chromium, 97 per cent grade, lb	85c.
Nickel, electrolytic cathodes, lb	35c.
Magnesium, 99.8 per cent, carloads, lb	30c.
Palladium, troy oz	$24.00
Platinum, (Official quotation) troy oz	$36.00
Quicksilver, flask of 76 lb., 100 flasks or more	$76.50@$78.50
Radium, mg. radium content	$40.00
Selenium, 99.5 per cent, lb	$2.00
Silicon, minimum 97 per cent, spot, lb	16.50c.
Tellurium, lb	$1.75@$2.00
Thallium, 100 lb. or more, lb	$6.50
Titanium, 96 to 98 per cent, lb	$6.00

METALLIC ORES

Beryllium Ore, f.o.b. mines, ton	$30.00@$35.00
Chrome Ore, 48 @ 50 per cent, c.i.f. Atl. ports, long ton	$22.00@$23.00
Iron Ore, Lake Superior, Lower Lake ports, long ton:	
Old Range bessemer	$5.25
Mesabi bessemer	$5.10
Old Range non-bessemer	$5.10
Mesabi, non-bessemer	$4.95
Lead (Galena) 80 per cent, Joplin, Mo., ton	$55.10
Manganese Ore, c.i.f. Atlantic ports, long ton unit:	
52 @ 55 per cent	35c.
50 @ 52 per cent	35c.
44 @ 48 per cent	30c.
Molybdenum Ore, 90 per cent, per lb. of contained MoS_2	45c.
Tungsten Ore, per unit of WO_3:	
Chinese, 65 per cent, duty paid	$20.50
Domestic, 70 per cent and upward	(a)$20.00@$21.00
Vanadium Ore, per lb. of contained V_2O_5	27½c.
Zinc, Ore, Prime, 60 per cent concentrate, Joplin, Mo.; per ton	$30.50

(a) Prices at mines, small lots, usually several dollars less.

METALLIC COMPOUNDS

Arsenious Oxide (arsenic) lb	3c
Cobalt Oxide, 70 @ 71 per cent, lb	$1.67@$1.77
Copper Sulphate, 100 lb	$4.25
Sodium Nitrate, ex vessel, in 200-lb. bags, per 100 lb	$1.42
Sodium Sulphate, bulk, ton	$13.00@$15.00

ALLOYS

Beryllium Copper, master alloy, 2.5 to 3 per cent Be, per lb. of contained Be	$23.00
Ferrochrome, 65 @ 70 per cent chromium, 4 @ 6 per cent carbon, lb	10½c.
Ferromanganese, 78 @ 82 per cent, gross ton	$92.50
Ferromolybdenum, 55 @ 65 per cent Mo. lb. of Mo contained.	95c
Ferrosilicon, 50 per cent, gross ton	$69.50
Ferrotungsten, 75 @ 80 per cent, lb. of W contained	$1.65

NON-METALLIC MINERALS

Asbestos, f.o.b. mines, ton:	
Canadian (Quebec)	
Crude No. 1	$700@$750
Crude No. 2	$150@$350
Spinning fibers	$110@$200
Paper stock	$40@$45
Shorts	$12@$16.50
Vermont	
Shingle stock	$57
Paper stock	$40
Cement stock	$25
Barytes, long ton:	
Georgia, crude	$7.00
Missouri, 90 per cent $BaSO_4$, less than 1 per cent iron	$6.00@$7.00
Bauxite, long ton:	
Domestic, chemical, 55 @ 58 per cent	$6.50@$7.50
Domestic, abrasive, 70 @ 84 per cent	$12.50@$15.00
Dalmatian, 50 @ 55 per cent	(a)$6.50@$7.50
French, 56 @ 59 per cent	(a)$8.00@$9.00
China Clay, f.o.b. mines, ton:	
South Carolina and Georgia, No. 1, bulk	$6.75@$8.00
Delaware, No. 1	$14.50
Feldspar, bulk, ton:	
Potash feldspar, 200 mesh	$17.00
Glass-spar, white, 20 mesh	$11.75
Fluorspar, f.o.b. mines, bulk, Kentucky and Illinois 85–5 per cent, all rail movement, ton	$18@$19
Fuller's earth, f.o.b. Georgia or Florida, ton	$7.00@$14.00
Magnesite, per ton:	
Dead-burned, f.o.b. California	$22.00
Dead-burned, f.o.b. Washington	$22.00
Mica, per lb., North Carolina, No. 1 and 2 quality:	
1½ x 2 in	15@40c.
2 x 2 in	30@60c.
3 x 3 in	75@$1.20
3 x 4 in	$1.00@$1.40
4 x 6 in	$2.00@$2.50
White, ground, 70 mesh, ton	$60.00@$80.00
Ocher, Georgia, ton	$19.00@$22.00
Pyrites, Spanish, per long ton unit of S, c.i.f. Atlantic ports	(a) 12@12½c.
Silica, in bags, 325 mesh, ton	$18.00@$40.00
Sulphur, Texas mines, long ton	$18.00
Talc, f.o.b. works, ton:	
New York, double air-floated, 325 mesh	$12.00@$15.00
New Jersey, mineral pulp	$8.00@$10.00
Vermont, extra white, 200 mesh	$9.00@ $9.50
Tripoli, Missouri, ton:	
40 mesh, cream colored	$14.50
200 mesh, cream colored	$26.00

(a) Nominal

IRON AND STEEL

Pig Iron, Valley furnaces, gross ton:	
Bessemer	$20.50
Basic	$19.50
No. 2 Foundry	$20.00
Steel, base prices, Pittsburgh:	
Billets, gross ton	$34.00
Structural shapes, 100 lb	$2.10
Bars, 100 lb	$2.25

Monthly and Yearly

AVERAGE PRICES

SILVER AND STERLING EXCHANGE

	New York		London Spot		Sterling Exchange	
	1937	1938	1937	1938	1937	1938
January	44.913	44.750	20.734	19.895	490.670	499.895
February	44.750	44.750	20.083	20.159	489.307	501.722
March	45.130	44.446	20.677	20.088	488.412	498.394
April	45.460	42.750	20.740	18.880	491.524	498.046
May	45.025	42.750	20.346	18.731	493.835	496.673
June	44.818	42.750	20.022	18.945	493.404	495.772
July	44.750	42.750	19.986	19.356	496.582	492.855
August	44.750	.....	19.848	.....	498.043	.....
September	44.750	.....	19.889	.....	495.145	.....
October	44.750	.....	19.942	.....	495.395	.....
November	44.750	.....	19.707	.....	499.467	.....
December	44.750	.....	18.835	.....	499.510	.....
Year	44.883	.....	20.067	.....	494.275	.....

New York quotations for silver other than newly-mined domestic, cents per ounce troy, 999 fine. London, pence per ounce sterling silver 925 fine. Sterling exchange (pound sterling) in cents.

COPPER

	F.O.B. Refinery, Electrolytic				London Spot (a)			
	Domestic		Export		Standard		Electrolytic	
	1937	1938	1937	1938	1937	1938	1937	1938
January	12.415	10.198	12.112	9.908	51.497	41.387	56.288	45.387
February	13.427	9.775	13.828	9.525	59.225	39.597	64.013	43.563
March	15.775	9.775	16.590	9.496	72.339	39.772	76.167*	43.582
April	15.121	9.775	14.692	9.443	62.506	39.306	66.614	43.408
May	13 775	9.375	13.999	8.801	61.118	36.668	63.684	40.852
June	13.775	8.775	13.492	8.500	55.696	35.235	61.409	39.417
July	13.775	9.585	13.817	9.573	56.412	39.744	62.807	44.405
August	13.775	.....	13.926	.....	57.143	.....	63.595	.....
September	13.530	.....	12.984	.....	52.989	.....	58.966	.....
October	11.838	.....	11.207	.....	45.384	.....	50.619	.....
November	10.797	.....	9.850	.....	39.321	.....	44.023	.....
December	10.006	.....	9.714	.....	39.946	.....	43.886	.....
Year	13.167	.....	13.018	.....	54.465	.....	59.339	.....

New York quotations, cents per pound. London, pounds sterling per long ton, (a) Bid quotation.

LEAD

	New York		St. Louis		London			
	1937	1938	1937	1938	1937 Spot	1937 3 Mos.	1938 Spot	1938 3 Mos.
January	6.000	4.870	5.850	4.720	27.272	27.150	16.135	16.253
February	6.239	4.632	6.089	4.482	28.319	28.328	15.402	15.525
March	7.190	4.500	7.040	4.350	33.027	32.979	15.992	16.075
April	6.175	4.500	6.025	4.350	26.014	25.878	15.579	15.623
May	6.000	4.400	5.850	4.250	24.000	23.891	14.210	14.376
June	6.000	4.148	5.850	3.998	22.878	22.759	13.969	14.012
July	6.000	4.882	5.850	4.732	23.932	23.703	14.921	15.034
August	6.452	.....	6.302	.....	22.606	22.670	.....	.....
September	6.400	.....	6.250	.....	20.990	21.044	.....	.....
October	5.740	.....	5.590	.....	18.259	18.318	.....	.....
November	5.033	.....	4.883	.....	16.706	16.714	.....	.....
December	4.875	.....	4.725	.....	15.905	15.994	.....	.....
Year	6.009	.....	5.859	.....	23.326	23.286	.....	.....

New York and St. Louis quotations, cents per pound. London pounds sterling per long ton.

TIN

	Straits New York		Standard, Spot London	
	1937	1938	1937	1938
January	50.925	41.548	229.350	183.619
February	52.010	41.373	233.750	183.144
March	63.043	41.219	282.988	183.473
April	59.172	38.430	267.136	168.612
May	55.651	36.885	250.645	162.693
June	55.851	40.376	249.852	177.429
July	59.245	43.428	263.540	192.542
August	59.465	.....	264.595	.....
September	58.675	.....	258.943	.....
October	51.654	.....	223.869	.....
November	43.299	.....	'90.477	.....
December	43.051	.....	190.449	.....
Year	54.337	.....	242.133	.....

New York quotations cents per pound. London, pounds sterling per long ton.

ZINC

	St. Louis		London			
	1937	1938	1937 Spot	1937 3 Mos.	1938 Spot	1938 3 Mos.
January	5.847	5.000	21.153	21.281	14.994	15.173
February	6.465	4.813	25.122	25.322	14.408	14.589
March	7.381	4.417	33.188	33.405	14.364	14.477
April	7.010	4.141	26.216	26.344	13.729	13.919
May	6.750	4.042	23.092	23.365	12.682	12.869
June	6.750	4.131	21.409	21.528	12.890	13.104
July	6.923	4.745	22.568	22.693	14.144	14.371
August	7.192	.....	24.140	24.290	.....	.....
September	7.190	.....	21.406	21.607	.....	.....
October	6.085	.....	17.722	17.955	.....	.....
November	5.630	.....	15.808	15.970	.....	.....
December	5.010	.....	15.274	15.429	.....	.....
Year	6.519	....	22.258	22.432	.....	.....

St. Louis quotations, Prime Western, cents per pound. London, pounds sterling per long ton.

CADMIUM AND ALUMINUM

	Cadmium		Aluminum	
	1937	1938	1937	1938
January	90.000	117.500	19.500	20.000
February	90.000	117.500	19.500	20.000
March	101.667	117.500	20.000	20.000
April	105.000	102.500	20.000	20.000
May	105.000	102.500	20.000	20.000
June	130.962	102.500	20.000	20.000
July	142.500	102.500	20.000	20.000
August	142.500	.....	20.000	.....
September	142.500	.....	20.000	.....
October	142.500	.....	20.000	.....
November	142.500	.....	20.000	.....
December	132.888	.....	20.000	.....
Year	122.335	.....	19.917	.....

Aluminum in cents per pound, 99 plus per cent grade. Cadmium, cents per pound, average of producer's and plater's quotations.

ANTIMONY, QUICKSILVER, AND PLATINUM

	Antimony (a) New York		Quicksilver (b) New York		Platinum (c) New York	
	1937	1938	1937	1938	1937	1938
January	14.130	13.750	90.250	79.240	50.400	36.000
February	14.563	13.750	91.000	76.455	64.364	36.000
March	16.375	13.750	91.778	72.444	58.000	36.000
April	16.043	13.654	92.000	71.019	58.000	36.000
May	14.830	12.460	95.520	74.640	54.800	33.400
June	14.702	11.731	96.654	80.731	53.000	33.231
July	14.803	11.030	93.904	76.860	50.115	36.000
August	15.327	.....	91.423	.....	51.000	.....
September	16.555	.....	89.020	.....	51.000	.....
October	16.935	.....	86.140	.....	48.560	.....
November	15.848	.....	83.435	.....	43.652	.....
December	14.144	.....	81.038	.....	38.385	.....
Year	15.355	.....	90.180	.....	51.773	.....

(a) Antimony quotations in cents per pound, for ordinary brands. (b) Quicksilver in dollars per flask of 76 lb. (c) Platinum in dollars per ounce troy.

PIG IRON

	Bessemer		Basic		No. 2 Foundry	
	1937	1938	1937	1938	1937	1938
January	21.50	24.50	20.50	23.50	21.00	24.00
February	21.50	24.50	20.50	23.50	21.00	24.00
March	24.20	24.50	23.20	23.50	23.70	24.00
April	24.50	24.50	23.50	23.50	24.00	24.00
May	24.50	24.50	23.50	23.50	24.00	24.00
June	24.50	23.73	23.50	22.73	24.00	23.23
July	24.50	20.50	23.50	19.50	24.00	20.00
August	24.50	.....	23.50	.....	24.00	.....
September	24.50	.....	23.50	.....	24.00	.....
October	24.50	.....	23.50	.....	24.00	.....
November	24.50	.....	23.50	.....	24.00	.....
December	24.50	.....	23.50	.....	24.00	.....
Year	23.975	.....	22.975	.....	23.475	.....

Iron in dollars per long ton. F. o. b. Mahoning and Chenango Valley furnaces.

What Metal Statistics Show

AUGUST was recognized as the month base-metal producers and miners received their first encouragement to share in the industrial recovery now under way. Metal prices have advanced since the latter part of June, copper from 9c. to 10⅛c., lead 4c. to 4.90c., and zinc from 4c. to 4.75c., per pound respectively. Metal sales have been higher and shipments to consumers have increased, with a consequent reduction in domestic copper, lead, and zinc stocks during June and July. Improvement in the statistical position has, so far, been moderate, and the industry hopes the movement to reopen mines will be on a similar basis, seeking to maintain stability in future employment as well as keeping production in line with the demand.

Operations resumed on a curtailed basis at Utah Copper on Aug. 1, reemploying about 2,500 men, after a shutdown since June 16. The Nevada Consolidated Copper Company also resumed operations on a part-time basis, at Ely, and at the smelter at McGill, Nev., reemploying about 400 men. The Tooele lead smelter, in Utah, reemployed about 200 men when operations resumed on Aug. 1. In the Tri-State area several mines and mills have reopened, and during July it is estimated about 700 men were put back to work.

Following is a record of sales of copper in the domestic market, by months, for 1936, 1937, and the first seven months of the current year, in short tons:

	1936	1937	1938
January	33,165	53,819	25,543
February	78,654	74,912	23,518
March	35,948	53,101	22,012
April	158,064	26,143	22,790
May	16,303	43,130	18,853
June	16,521	35,395	87,730
July	175,484	62,298	124,054
August	25,253	69,225	.....
September	40,769	28,936	.....
October	178,801	23,238	.....
November	88,177	21,035	.....
December	117,715	26,504	.....
Totals	964,854	517,736	.....

The copper statistics of the Copper Institute for June, with comparable figures for May, in short tons, follow:

	May	June
Production (blister):		
U. S. Mine	38,306	31,399
U. S. Scrap, etc	10,819	6,243
Foreign Mine	94,410	93,185
Foreign Scrap	12,789	12,985
Totals	156,324	143,812
Production (refined):		
U. S. Duty-free	47,300	32,465
Foreign	102,044	110,067
Totals	149,344	142,532
Deliveries to customers (refined):		
U. S. Domestic (a)	28,044	32,863
U. S. Exports (a)	5,110	10,440
Foreign	103,413	102,090
Totals	136,567	145,393
Stock at end (refined):		
U. S. duty-free	369,809	358,971
Foreign	184,547	192,524
Totals	554,356	551,495

(a) Duty-free (chiefly domestic) copper.

Stocks of domestic refined copper declined 9,838 tons in June and mine production (blister) was reduced 6,907 tons. Statistics for July are expected to show further improvement.

▶ LEAD—Production of lead is estimated to have continued on a basis around 34,000 tons during July. Shipments to consumers are expected to be around 40,000 tons; therefore, the first reduction in stocks in several months is anticipated by the industry for July. The labor strike at the East Helena lead smelter effective since July 6 still continues. The Morning mine, in Idaho, closed since June 25, planned resumption of operations in August, but officials recently announced work would be resumed as soon as the East Helena plant reopened to receive their ores.

The American Bureau of Metal Statistics' figures on refined lead for May and June, in short tons, follow:

	May	June
Stock at beginning	156,715	163,723
Production:		
Domestic ore	31,918	33,992
Secondary and foreign	1,059	1,036
Totals	32,977	35,028
Domestic shipments	26,011	35,343
Stock at end	163,723	163,346

The following tabulation shows total lead stocks at the works of smelters and refiners in the United States so far as reported, in short tons:

	June 1	July 1
In ore, matte, process (a)	52,141	45,824
In base bullion:		
Smelters and refineries	12,227	12,038
In transit to refineries	1,138	1,855
In process at refineries	14,962	13,707
Refined lead	150,760	151,781
Antimonial lead	12,963	11,565
Total stocks	244,191	236,770

(a) At smelters.

Low prices for lead in London continue to depress the price here; otherwise the trade believes the domestic quotation would be higher in view of the improved demand for metal.

▶ ZINC—The June and July statistics of the American Zinc Institute, covering all grades, are summarized as follows in short tons:

	June	July
Production	30,799	30,362
Production, daily rate	1,027	979
Shipments	29,248	33,825
Stock at end	149,671	146,208
Unfilled orders	41,785	39,350

Statistics of the Prime Western division, common grades only, for June and July, follow:

	June	July
Stock at beginning	64,667	66,675
Production	14,657	13,869
Shipments	12,649	16,689
Stock at end	66,675	63,855

Stocks of zinc declined in July for the first time since August last year. The drop totaled 3,463 tons, of which 2,820 was Prime Western and the remainder High Grade.

▶ TIN—Countries that account for practically all of the tin production in the world, Belgian Congo, Bolivia, French Indo-China, Malaya, Netherland East Indies, Nigeria, and Siam, are seeking means through their International Tin Committee to regulate the price of tin. A Tin Buffer Pool plan was agreed upon in London on June 20, and the provisions according to an announcement issued on July 7 are:

1—The Buffer stock shall be administered as an adjunct of the International Tin Committee.

2—The stock in the first place will consist of approximately 10,000 tons, increasable to a maximum of 15,000 tons.

3—The signatory countries will be entitled to contribute to the Buffer Pool stock prorata of their standard tonnages. If any signatory country is not prepared to contribute the full amount to which it is entitled, the balance will be offered on a prorata basis to the other signatories.

4—All contributions to the Buffer stock will be included as soon as possible in the visible supply.

5—The Buffer stock will be administered by an executive appointed by a subcommittee of the International Tin Committee. (R. G. Mills, a director of the Brazilian Warrant Agency & Finance Company, was appointed Aug. 4.)

6—With the exception of certain specific information to be furnished to the International Tin Committee, the operation of the executive will be strictly private.

7—The present objective of the scheme is the maintenance of the price between £200 and £230 sterling.

8—Operations will be carried out through dealer members of the London Metal Exchange, with transactions being spread as far as possible among all members.

CALIFORNIA

Debris Dam Construction Gets Under Way

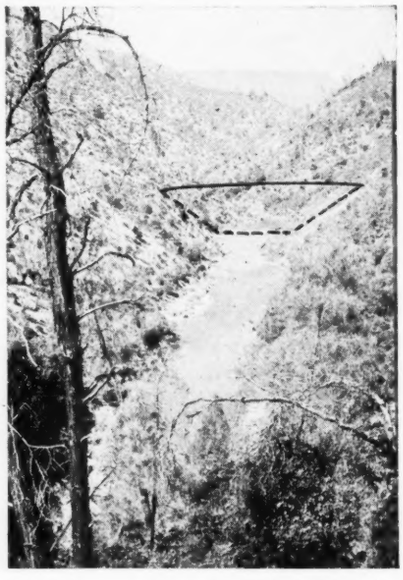
First work started on the North Fork—Rindge No. 1 mine to be reopened after long shutdown—Furnace installed at Contact quicksilver mine

▶ The matter of early revival of hydraulic mining in the central part of the Sierra Nevada has been helped considerably by the allocation of an additional $1,000,000 on the part of the United States War Department for erection of débris dams, which, with the $1,500,000 already provided, will make possible early construction of both the Ruck-A-Chucky dam, on the Middle Fork of the American River, about 11 miles east of Auburn, and the Narrows dam, on the Yuba River near Smartsville. Bids for these dams will be called for soon. The program outlined by the army engineers calls for construction of four débris dams on different tributaries of the Sacramento River at an estimated cost of nearly $7,000,000. Work on the first unit, the North Fork dam, 5 miles northeast of Auburn, was started early in June by Teichert & Son, Inc., Sacramento contractors, and foundation and coffer-dam operations are reported to be progressing satisfactorily. Irwin E. Burks, who is resident engineer, will also supervise construction of the Ruck-A-Chucky and Narrows dams for the War Department. A bill, introduced at the last session of Congress by Representative Harry L. Englebright and which became law on June 25, authorizing the Secretary of War to enter contracts as regards to sale of water and outlet facilities provided by the dams, promises to reduce materially the ultimate storage cost to be paid by the miners. Under the amendment provision is made for the sale of water for irrigation and power purposes from the dams. The funds so derived would be applied to the cost of the dams, thereby reducing the total to be paid by the mine operators.

▶ After being idle since 1929, work has been started on the Rindge No. 1 mine, in the Jesus Maria district near Mokelumne Hill. The property, consisting of quartz and placer holdings, was recently acquired by J. V. Maynes and Eastern associates, who plan to start dragline operation at once on the placer portion, water to be obtained from the unwatering operations to be started soon at the 750-ft. three-compartment Rindge shaft. A considerable tonnage of ore is said to have been blocked out by underground work done before the shutdown in 1929 caused by litigation.

▶ Consolidation of four well-known gold properties in the Stent mining area, near Jamestown, the App, Dutch, Heslep, and Sweeney, has been effected by a syndicate headed by Sidney B. Wood, Jr., president of Gold Diggers Syndicate, Inc., after negotiations with Chas. H. Segerstrom, prominent mining man of Sonora. The lease-and-bond agreement is reported to call for payment of $350,000 and construction of a large milling plant before Jan. 1, 1940. For more than two years Gold Diggers Syndicate has conducted tests on the Heslep mine with a 50-ton flotation mill, which operations are said to have yielded some $175,000 in gold. Immediate work to be undertaken by the new company includes dewatering the three-compartment shaft at the Dutch property, through which all future mining will be conducted. Roy K. Brown is in charge of the Heslep operations.

▶ A new wage agreement of eighteen months' duration has been accepted by Grass Valley-Nevada City mine operators and the Nevada County Mine Workers Protective League, an independent labor union. With the exception of a minimum wage scale, wages remain the same at $5.76 for miners and $5.24 for muckers. Apart from the Idaho Maryland Mines Corporation and Lava Cap Gold Mining Corporation, all major companies are parties to the agreement.



Looking up the North Fork river to the site of a debris dam now under construction that will facilitate hydraulic gold mining in Calif.

▶ Pacific Mining Company, P. R. Bradley, Jr., manager, is deepening the 850-ft. shaft at the Pine Tree mine, Bear Valley, another 100 ft., after preliminary testing of the ground by diamond drilling. The 175-ton flotation mill is operating steadily.

▶ Increased activity in the Banner mining district near Julian, San Diego County, is expected following the acquisition of the North Hubbard-Ready Relief group of claims by Ogden Chase and associates, of Salt Lake City, Utah. Development work has already been started under the direction of George B. Guillotte.

▶ The Silver Prince mine, on Middle Buttes, near Mojave, has been closed permanently by the Golden Queen Mining Company after one year of operation, during which considerable shaft work and drifting were carried out. All equipment is being returned to the Goldeen Queen mine. W. C. Browning is general manager of the company.

▶ Preliminary exploration work involving the driving of a tunnel is to be started at the Rattlesnake mine, near Downieville, Sierra County, held under option by Roy H. Elliott, consulting engineer, San Francisco, as soon as the road leading to the property has been completed and equipment brought in.

▶ Two new mills are to be added to existing milling plants in the Grass Valley-Nevada City mining area. A 50-ton ball mill and cyanide plant is to be installed at the property of Stockton Hill Corporation, Grass Valley, headed by W. R. Woock, and a 50-ton mill is in course of erection at the Mount Vernon mine, near Nevada City, where twelve men are employed under Thomas Brown.

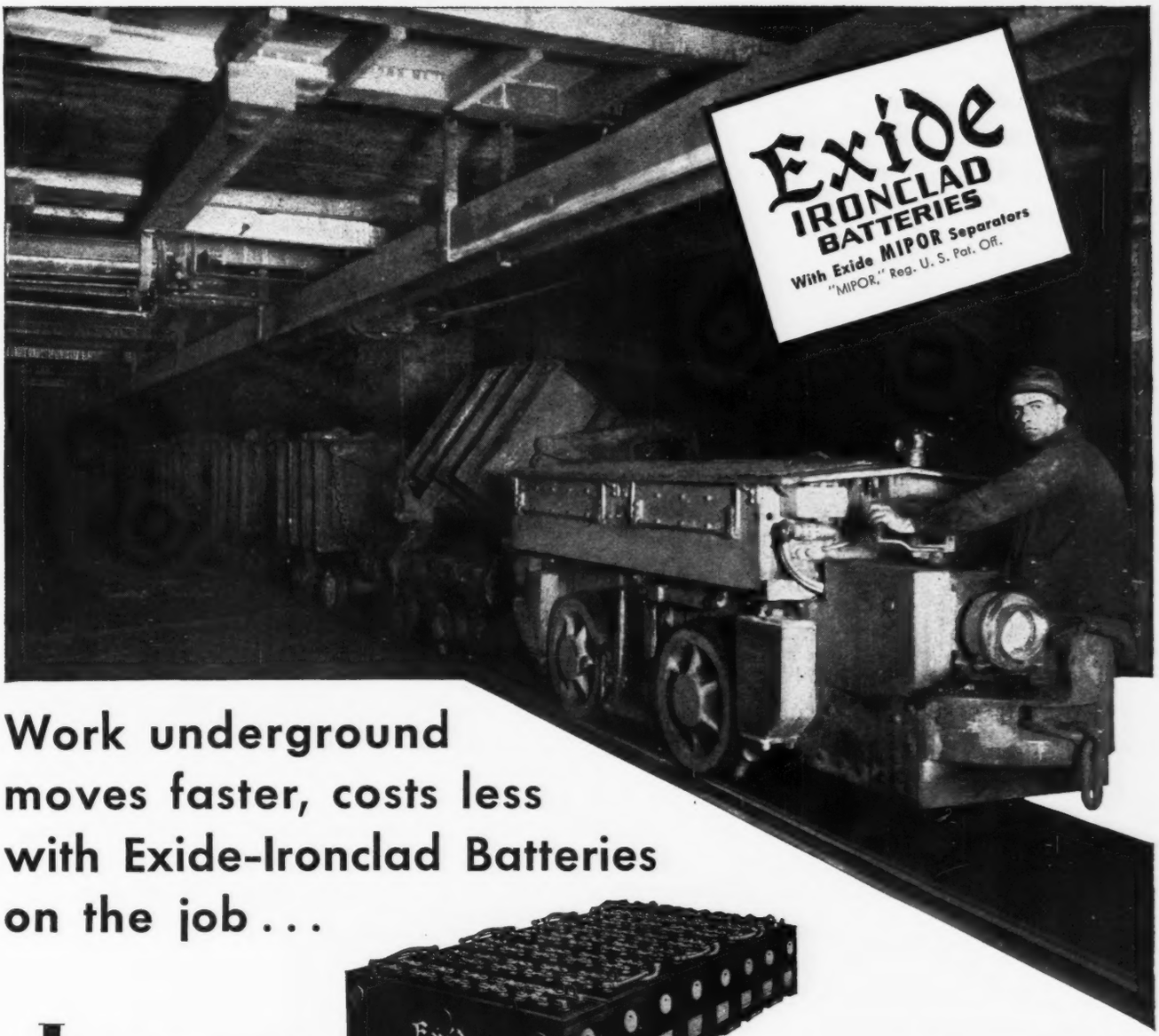
▶ On the Mother Lode, Central Eureka Mining Company has completed the new plant for treatment of tailings and concentrates at its property at Sutter Creek. It is capable of handling 150 tons of material a day, and is equipped for flotation and cyanidation. James Spiers, superintendent, is in charge of operations. At Shingle Springs, milling operations have been started at the El Dorado Crystal mine, where a 125-ton cyanide mill was completed recently. Benoni Lockwood, Jr., is in charge of operations and William Crowfoot is metallurgist. The property is controlled by Oakleigh Thorne, L. T. Pockman, and D. W. Johnston.

▶ According to a report from Nevada City, Lava Cap Gold Mining Corporation, Otto E. Schiffner, general manager, has commenced sinking the Central shaft another 300 ft. to 2,200 ft. The flotation mill is treating more than 300 tons a day, and work has been completed on the tailings dam on Greenhorn Creek, built to stop tailings from polluting the waters of Bear River.

▶ Control of the entire Greenhorn Creek placer area south of Yreka, including some municipal property, has been acquired by Lord & Bishop, dragline dredge operators, and extensive testing of the ground is now in progress. If results are favorable, several dragline units may be installed.

▶ A recovery plant, including a large rotary furnace, is being installed at the Contact quicksilver mine, near Healdsburg, following development of rich ore in new workings. The property is operated by H. G. Walker, Reno.

▶ The Fifth Annual Metal Mining Convention and Exposition of the Western Division of the American Mining Congress will be held in Los Angeles, Oct. 24 to 27. Among subjects to be discussed are: industrial relations; taxation, with special reference to the mining industry; outlook for precious and base metals and non-metallics; financing of mining properties; reciprocal trade agreements; wage-hour legislation; dust elimination; and mine safety. T. H. O'Brien, general manager of Inspiration Consolidated Copper Company, is chairman.



Work underground moves faster, costs less with Exide-Ironclad Batteries on the job . . .

IN mining, quarrying or tunneling, the underground haulage system plays such a vital part that the batteries you use make a big difference. Not only a difference in speed and productivity, but a significant difference in costs.

This has been the experience of men engaged in every kind of underground operation, and it accounts for the fact that Exide-Ironclads are the most widely used batteries in underground haulage service today. For these batteries, with their high power ability, sustained voltage, and long trouble-free life, are a dependable means of speeding up the work at a saving.

In mines where production costs are notably low, and in tunneling operations where the work proceeds with record speed, you will find these batteries faithfully on the job. Why not let Exide-Ironclads improve your haulage service and cut costs? Write for free booklet, "The Storage Battery Locomotive for Underground Haulage."

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia

The World's Largest Manufacturers of Storage Batteries for Every Purpose

Exide Batteries of Canada, Limited, Toronto

UTAH

Improved Outlook for Workers and Operators

Resumption at Utah Copper and signing of sliding-scale wage agreement between workers and companies add stability to State's mining industry — Tooele lead smelter reopens

▶ Conditions shaping the prosperity of the Utah non-ferrous mining industry took a turn for the better with the first of August. Two events justify this statement: The Utah Copper Company, through D. D. Moffat, vice-president and general manager, announced that operations would be resumed on Aug. 1 at the same rate of production in effect at the date of the shutdown, June 16. At this time, the company was employing 3,300 men at its open-cut Bingham mine and Garfield and Arthur mills. Reopening of the property will mean that the Garfield smelter of the American Smelting & Refining Company will not have to shut down. The second favorable development was the acceptance by members of the International Union of Mine, Mill, and Smelter Workers of a two-year sliding-scale contract governing wages. A referendum vote of 5,900 members in Park City, Tintic, Bingham, Tooele, Midvale, and other camps ratified the pact, which extends until June 30, 1940. Under the new contract, minimums for smelter workers were raised from $3.50 to $4 daily; for muckers from $3.75 to $4.25 daily; and for miners from $4.25 to $4.50. The scale is based on a 9c copper price, unless lead drops below 40 per cent of the copper price, when new negotiations will have to be undertaken. James W. Wade spokesman for the mine operators, predicted the contract would have a stabilizing influence on the Utah mining industry.

▶ The old Hidden Treasure mine, in Dry Canyon, in the Ophir district, was taken over by the United States Smelting, Refining & Mining Company on July 1. Previously operated under lease by R. A. Glenny and C. S. Lynch, of Salt Lake City, the United States company acquired the property from Philadelphia owners for a price said to be $450,000. Company engineers are engaged in studying and mapping the property preliminary to operation next year.

▶ Rumor says that operations are soon to be resumed at the Park City Utah Mines property. A promising strike was made several years ago in this mine, but development was stopped by litigation. The company has quieted title to the disputed ground, and now, it is said, a crew of men are cleaning and repairing the Wasatch tunnel on the east side of the district.

▶ Operations have been resumed at the old American Flag mine, closed in the summer of 1936. Douglas C. Despain, in charge of operations at the Park City property, has taken a lease on this ground and that of the Park City Development Company. Twenty men are employed. A production of 50 tons daily of lead-silver-zinc ore is planned by Mr. Despain.

▶ Final touches are being put to the Utah Copper vehicular tunnel, and before the month of August is over, traffic from Bingham to Copperfield will be passing through the mile-long tunnel rather than over the old road used for decades, soon to be removed by mining operations.

▶ The International Smelting & Refining Company reopened its lead smelter at Tooele on Aug. 1. The plant was closed on July 1, and it is reported present operations will depend upon ore receipts, as present stock at the smelter will provide operations for one furnace about six weeks and employ between 175 and 200 men.

▶ The United States Smelting, Refining & Mining Company announced on July 12 that High Grade zinc has been added to its products to be sold directly to the trade. Heretofore the zinc concentrate, mined at Bingham, was sold to Anaconda Copper Mining Company. Under a new arrangement, the concentrate will be treated by Anaconda for account of the United States Smelting, Refining & Mining Company. Electrolytic zinc will be offered in the following grades: Special High Grade, 99.99 plus per cent zinc; Intermediate; Brass Special; and Prime Western. The zinc will be sold through the New York office.

ARIZONA

Greater Activity Among Lode and Placer Mines

Flotation plant and gold dredge to be operated on Papago Indian Reservation—Non-metallic producers maintain steady shipments—Copper miners encouraged

▶ The Lost Horse group of claims, situated about 70 miles southwest of Tucson, together with the Fresnal placers, both on the Papago Indian Reservation in the Baboquivari Mountains, are being developed by E. M. Henshaw, Arizona Hotel, Tucson, manager, and E. S. Edwards, Box 1747, Tucson, superintendent. A 25-ton flotation plant will be installed on the Lost Horse claim and a 1,000-yd. per 24-hour gold-recovery plant employing jigs will be operated on the placer properties.

▶ Higher prices for copper during the last month have encouraged copper miners throughout the State, and if actual consumption of the metal by fabricators and other consuming interests should increase over the remainder of the year, production schedules at copper mines should soon begin to reflect such improvement.

▶ On Aug. 4 the first wage increase based on the sliding scale of copper prices was given to employees of the Phelps Dodge Corporation, Miami Copper Company, and Inspiration Consolidated. About 5,000 persons receive the increase and miners' wages advanced from $5 to $5.48 per day. The New Cornelia unit of the Phelps Dodge Corporation is expected to resume operations on Aug. 22, following a shutdown since Aug. 1.

▶ Magma Copper Company in its report to stockholders for the first six months of the year reported that 19,143,396 lb. of copper were produced for the period. The usual summer close-down period began July 2, and operations are expected to resume again early in August.

▶ Lester Heacock, formerly an engineer in the employ of the Boriana mine, near Yucca, in Mohave County, associated with Ed. Moriarity, of Kingman, and A. R. Jones, of Los Angeles, has recently taken over the M. O. mining claim, a part of the O. K. group in Gold Basin, and started development work.

▶ The M. A. Hanna Company, of Cleveland, Ohio, has completed diamond drilling operations for the season on the Arizona Manganese Company's properties at Artillery Mountain in southern Mohave County.

▶ The Cat's Paw silver mine, south of Tucson, has a development crew at work under the management of Hyman Pittelman. Ore shipments are expected to commence soon.

▶ Rich Hill Associates, Inc., are developing a group of seven claims in the Weaver district near Octave. A tunnel is being driven to cut the veins at lower levels. Work is under the direction of W. R. Mohney, of Yarnell.

▶ The Galena mine, owned by J. A. Hagan, of Clifton, and being operated by lessees, has commenced shipping gold-silver ore to the A. S. & R. smelter at El Paso, Tex.

▶ Equipment for a 50-ton mill is being installed on the Extension mine, 7 miles southwest of Dragoon. Eastern interests recently purchased the property. The Extension group consists of fourteen claims and was sold by Ralph O. Wise, of Mansfield, Ohio. Hamilton C. Dowell and Russell R. Wilkinson, of Fort Wayne, Ind., and Marion G. Stanley, of Pittsburgh, Pa., represent the new owners. In addition to the mill, a 300-cu.ft. compressor is being installed. Don Douglas is superintending the work.

▶ The Greenback Company, near Casa Grande, has started operations through the old Pinal shaft. The shaft has been sunk to the 600 level on the incline, and several oreshoots have been opened. The Greenback shaft, on the same property, is under lease to George W. Long, 118 East Coronado Road, Phoenix, who is preparing to start operations.

▶ About 25 tons of asbestos per month are being mined from the Canadian mine, near Chrysotile. The property is owned by the Globe-Los Angeles Mining Company. Norman F. Barber, lessee, Box 1010, Globe, Ariz., is in charge.

▶ Barium-ore shipments from the White Mountain mine, near Bouse, approximate 10,000 tons per month. The mine is owned by R. E. Scott, 1012 Holly Ave., Arcadia, Calif. T. H. McReynolds, Bouse, Ariz., is superintendent.

JACKBITS *Used* EXCLUSIVELY

IN THREE MINES of the AMERICAN ZINC, LEAD & SMELTING CO.

The Famous I-R Jackbit and Jackrod.

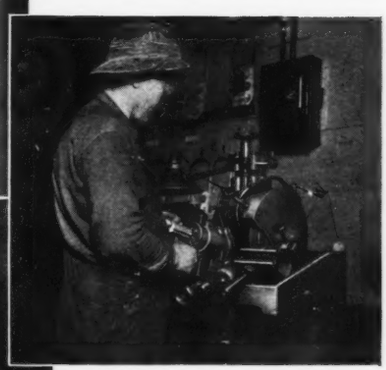
After very exhaustive tests Jackbits were adopted 100% at the Mascot No. 2 Mine in 1934. The savings resulting from their use in this mine caused the American Zinc, Lead & Smelting Company to adopt these bits 100% in their mines at New Market and Jefferson City, Tennessee.

The American Zinc, Lead & Smelting Company is an excellent example of what keen, progressive management can achieve by coordinating the various phases of mining and smelting. Ingersoll-Rand extends their congratulations.

We are proud of the fact that I-R rock drills, Jackbits, compressors, scraper hoists, pumps, pneumatic tools and accessory equipment have contributed in some part to this successful enterprise.

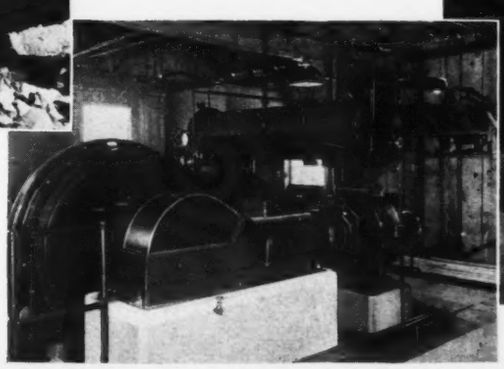
The extensive use of this equipment by the American Zinc, Lead & Smelting Company, over a period of many years, is proof of the efficiency, dependability and reliability of Ingersoll-Rand products.

When you plan larger operations, or replacement of obsolete equipment, do not fail to investigate the I-R Line. There is no substitute for high-grade machinery.



One of the I-R Jackbit Grinders in a mine shop.

A Jackhamer on a column mounting. Note the Jackbits.



A type PRE Compressor which for many years has been supplying air for operating rock drills and air chutes.

A large, two-stage Cameron Pump handling 3000 gpm. of mine water at a 600-foot head.

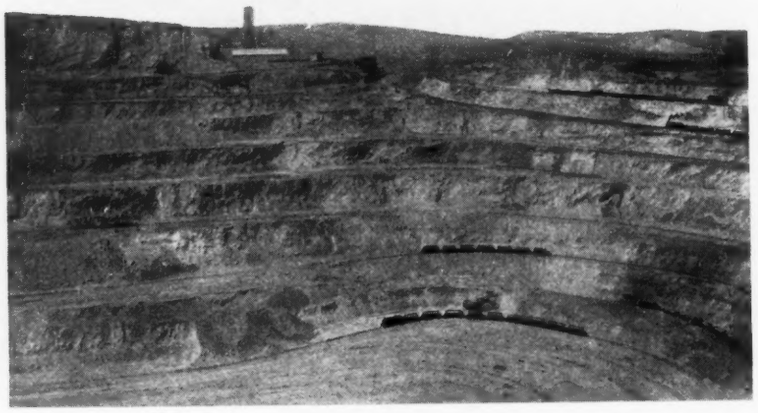
Atlanta · Birmingham · Boston · Buffalo · Butte · Chicago · Cincinnati · Cleveland · Dallas · Denver · Detroit · Duluth · El Paso · Hartford · Houston · Kansas City · Knoxville · Los Angeles · Newark · New York · Philadelphia · Picher · Pittsburgh · Pottsville · Salt Lake City · San Francisco · Scranton · Seattle · St. Louis · Tulsa · Washington

Ingersoll-Rand

11 BROADWAY NEW YORK, N. Y.

For Canada refer — Canadian Ingersoll-Rand Company, Limited, New Birks Bldg., Phillips Square, Montreal

Havana · Mexico · Barranquilla · Buenos Aires · London · Brussels · Bucuresti · Calcutta · Bombay · Singapore · Bangkok



Ruth pit of the Nevada Consolidated Copper Company near Ely, Nevada, where production was resumed on Aug. 1 on a curtailed basis, following a shutdown since June 16

NEVADA

Stripping Operations Resumed at Ruth Pit

Production on a curtailed basis was started Aug. 1 — Dayton Consolidated Mines, Inc., obtains lease on gold property

▶ Stripping operations have been resumed in the Ruth pit mine of the Nevada Consolidated Copper Corporation, and production of ore has been started. The flotation concentrator at McGill has been running four days per week on ore from the underground mines of the Consolidated Coppermines Corporation at Kimberly.

▶ Supplying its 150-ton cyanide mill from its Dayton mine and from the Justice and Keystone mines, both leased from the Comstock Keystone Mining Company, Dayton Consolidated Mines, Inc., has acquired under lease and option of purchase the West mine, a former producer west of the Dayton mine, near Silver City, in Lyon County. Sections of all four mines will be leased, and applications have been received for a number of blocks. The Dayton mill is now treating a considerable quantity of custom ore. Homer L. Gibson is president and manager.

▶ Acting on the application of the Arizona Comstock Corporation for permission to reorganize under Sect. 77b of the Federal bankruptcy act, Judge F. H. Norcross of the Federal district court at Carson City has accepted the resignation of W. J. Loring as president and managing director and appointed as trustee James M. Leonard, of Virginia City, president of the Comstock Tunnel & Drainage Company. Open-cut mining and operation of the 400-ton flotation mill have been suspended for the present, but the auxiliary cyanide plant is treating around 150 tons of impounded flotation tailing per day. A recent statement by Mr. Loring attributed current economic difficulties to inadequate financing and consequent metallurgical failure, since the ore of the Comstock lode does not respond satisfactorily to flotation. An operating summary shows gross production from September, 1933, to May 24, 1938, of 498,569 tons, with value of $2,581,845, and with metal recovery of $1,692,018. It was shown that in this period the operation of an adequate cyanide mill would have increased revenue by 27 per cent.

▶ The lately completed cyanide mill and roasting plant of the Getchell Mine, Inc., in eastern Humboldt County, with rated capacity of 600 tons per day, has been treating over 700 tons per day, and this volume is soon to be increased, according to George Wingfield, president. Installation of two 14x14-ft. filters has remedied earlier slime difficulties, improvements have been made to oil-feed units in the 100x7-ft. Gould roasting furnace, and dust collectors have been provided. Calcined ore from the furnace passes to a 7-ft. Hardinge ball mill, and thence by a Wilfley pump to the cyanide circuit. Noble H. Getchell is manager.

▶ A new flotation mill at the A. C. McMillan mine, in Spring Canyon, Humboldt County, is treating 25 tons of gold-silver ore per day with satisfactory recovery, according to a statement by the owner. He is said to have opened a substantial tonnage of pay ore in recent development. Part of his property is under lease to C. Colvin. Both make their headquarters at Winnemucca.

▶ Gold discoveries, still unproved as to their importance, have been made at several points in the Awakening district, in central Humboldt County, near the Jumbo mine, which was optioned in May, 1937, by George B. Austin to a group of Texas oil operators, for a total purchase price of $10,000,000 and $250,000 down payment. Under the name Jumbo Mine, Inc., the Texas optionees continue to employ a force of some 30 men and to treat around 45 tons of gold ore per day in the Austin mill, employing amalgamation and table concentration. Several groups of Idaho mining men have acquired claims and are working in the district.

▶ Engineers acting reputedly for Utah interests have been sampling the property of the Lucky Boy Consolidated Mines Company in the Hawthorne district, in Mineral County. Development includes a number of shafts, the deepest 950 ft., and a 6,000-ft. tunnel at 1,000-ft. depth. Silver-lead orebodies are replacement deposits in limestone. John H. Miller, of Hawthorne, is president and manager.

▶ Development of unexplored parts of the old Berlin gold-silver mine, near Ione, northern Nye County, has been undertaken by J. M. Hiskey, of Austin, who has charge of Nevada holdings of J. G. Phelps Stokes, of New York. In areas north and south of the old workings a bulldozer is used in the search for vein outcrops.

▶ The power plant, 200-ton mill, and other equipment of the Nevada State Gold Mines, Inc., at Seven Troughs, Pershing County, have been reconditioned in preparation for early expansion of work, according to Stuart Williams, manager. Thomas F. Cole, of Pasadena, Calif., heads the company.

IDAHO

Callahan Consolidated To Reopen Rex Mine

Company plans development of lead-zinc properties in the Nine Mile District—Operations at Polaris on the lowest level continues encouraging

▶ An aggressive development campaign is now getting under way at the property of the Callahan Consolidated Mines, Inc., according to announcement of the officials. The company owns large holdings in the Nine Mile district, near Wallace, a consolidation of several important groups from which upward of $2,000,000 in lead-zinc-silver shipments have been made in past years. Included in the holdings is the Rex mine, one of the district's heavy producers of some years ago when lead and zinc commanded higher prices. Plans of the management call for the opening of the Rex vein at greater depth and a reopening of several levels of the main shaft where extensive orebodies are known to exist. Officers of the company are well known in mining circles of the northwest. Donald A. Callahan, president, has been engaged in operations in the district for a number of years. He was formerly president of the Callahan Zinc-Lead Company and is well known in national mining circles as a vice-president of the American Mining Congress.

▶ The Western Gold Corporation, headed by S. K. Atkinson, well-known Boise operator, has acquired under lease and option 800 acres of ground on Wilson Creek, which flows into the Deadwood

FAST, ECONOMICAL DRILLING

At the American Zinc & Lead Smelting Company's Mines

ASSURED BY GARDNER-DENVER EQUIPMENT

A Gardner-Denver Drifter, one of many in the mines of the American Zinc & Lead Smelting Company in Tennessee, and in the Tri-state district. Eighteen Gardner-Denver drills are in use at Mascot—twenty-one are used at the Oronogo Mutual Mining Company in recovering rich zinc-lead pillars that remain in this mine. Wherever used, Gardner-Denver drills are proving their economy.

Bulletins giving complete information about Gardner-Denver rock drills and equipment are yours on request. Gardner-Denver Company, Quincy, Illinois.

Since 1859

GARDNER-DENVER

▶IDAHO

River. Actual operations on the ground, not all of which is dredgable, will not be started this year, although a prospecting crew started testing the ground about July 15, Atkinson said.

▶ Drifting on the vein on the 1,900-ft. level of the Polaris mine is now under way and is meeting with excellent results, according to word from the management. The drift is in ore, high in silver content and of a more extensive nature than in any other disclosure in the mine. The length of the orebody on this deep level will be determined by drifting, but indications point to a long shoot of commercial ore from which a large tonnage will be available for mill treatment. President James F. McCarthy states the showing on this level and the ore disclosed by the drift to be satisfactory to the management.

▶ The Liberal King mine, on Pine Creek, is the scene of deep operations, the shaft having reached the 500-ft. level, from which point it is understood a crosscut will be extended to the vein. The stockholders have elected Clem J. Whittemore, Seattle; Henry G. Weber, Rose Lake; Dr. Thomas Curran, Tacoma; O. E. Stokke and George Vandevere, Seattle, directors for the new year. H. J. Hull, Wallace, was appointed secretary-treasurer. The directors have levied an assessment of one cent per share to secure funds for the further development of the property.

▶ At the property of the Hope Silver-Lead Mines, Inc., Albert Nash, Kellogg mining engineer, is successfully maintaining operations. He took over the mine more than two years ago after it had been idle for a number of years. Two and three cars of concentrates were shipped monthly to the smelter. Total shipments from the mine amount to $375,000, Mr. Nash states.

▶ Midland Mining Company, operating the Terrible Edith and associated properties, formerly held by the Pontiac Mining Company, in the Murray district, has registered its stock with the SEC in Washington and is now ready to proceed with an active program at the mine, according to officials of the company. President H. C. Eastman, of Midland, Mich., recently informed local officials of the registration and is starting financing of the new work under way. Ruth Hodges, of Kellogg, is secretary of the corporation and H. C. Stapleton, of Murray, is in charge of operations at the mine.

▶ The shaft at the property of the Coeur d'Alene Mines Corporation in the silver belt has reached the 1,000-ft. level, according to Joe Grismer, contractor, who has again set some new records for shaft sinking.

▶ Down in Owyhee County, Idaho's famous silver district of 75 years ago, renewed activities may again place that section in the production figures of the State, according to State Mine Inspector Arthur Campbell, who recently made a survey of operations in the Silver City area. Among the new operations planned there is one by George Gage, formerly of Portland, who is reconstructing a 50-ton flotation mill on the old Dewey mine dumps. Mill equipment was moved from the Mountain Chief mine.

▶ Machine drills are now operating following recent installation of a compressor at the property of the Palisade Mining Company, high on Mount Baldy at the head of the west fork of Pine Creek, in the Coeur d'Alenes, according to Theo. Schmidt, manager.

▶ At the Orogrande mine, on War Eagle Mountain, in the French district, 200 ft. of tunnel have been driven and the operators expect to drift another 60 ft. on the vein before reaching their main objective.

CHINESE SILVER PURCHASES

SECRETARY of the Treasury Morgenthau, at a press conference in Washington on July 14, disclosed that the United States and China had extended the agreement to purchase Chinese silver.

THE OLD AGREEMENT expired on July 15. The Secretary did not state the length of time the new agreement would remain in force, but said that purchases would be made at the price the metal is quoted on the day it arrives in New York or other receiving points. Since the first agreement was announced on May 18, 1936, the Treasury has purchased between 275,000,000 and 325,000,000 oz. of Chinese silver.

MONTANA

Strike at Lead Smelter Continues

Many small base-metal producers forced to suspend operations — Higher copper price nets wage increase for workers

▶ The East Helena smelter of the A.S.&R. Company, after failing to secure a wage reduction, closed down on July 6 and thereby effected suspension of small producers of high-grade base ores throughout the State.

▶ As yet there has been no announcement as to the date of reopening the mines or smelters of the Anaconda Copper Mining Company. The slight improvement in the copper price is looked upon as encouraging, but it is still quite apparent that stocks have not been materially reduced, and that any resumption of production might rapidly reverse the price trend. Wages, however, were raised on Aug. 4. Due to higher copper prices, miners base wages increased from $4.75 to $5.25 per day.

▶ Recent developments on the lowest (725) level at the Butte Highlands mine, south of Butte, have been successful. The ore horizon was penetrated for a distance of 22 ft. and an average assay of $38 a ton in gold is reported. A 17 ft. drift from the crosscut along a high-grade horizon averaged 5.17 oz. gold per ton. Conditions at the mine have steadily improved since November 1937, when the management and control was taken over by W. S. Norman and W. L. Bell, of Spokane. Current improvements include reconditioning the main haulageway for electrifying and doubling the present 60-ton cyanide mill rate.

▶ Operations at the Jardine mine, in Park County, were interrupted during July, first by labor trouble and then, when that had been adjusted, by an act of God. Upon a refusal to accept a wage reduction, the mines were closed on July 1, but reconsideration resulted in acceptance of a wage reduction, and the operation was resumed about the middle of the month. However, two days later, lightning struck the central power plant, inflicting damages requiring factory replacements which will induce a shutdown until sometime early in August. During recent months an active development campaign has been conducted under L. E. Riter, manager. Stoping of old pillars has permitted operation of the mill on relatively low-grade material throughout this period, but the future of the property is largely dependent on the completion of the development program in progress. The future ores will be of the disseminated arsenopyrite type.

▶ Sinking to the 600 level is the immediate plan of the management at the Ruby Gulch mine, at Zortman, in the Little Rockies. Operations have been steadily maintained at the 300-ton capacity of the company's cyanide plant. About 120 men are employed under the management of George Whitcomb.

▶ Under the direction of J. J. Beeson, developments at the McLaren Gold mine, in the Cooke City district, are being rushed during the short open season. Several diamond drills are being used, in addition to an extensive program of underground developments. Outlying acreage is being explored by bulldozer trenching and pitting. No production is in progress, and the company's mill at Cooke is idle. Plans to construct a new 500-ton mill more suitable to the ore type and more conveniently located are, however, under consideration, but no announcement has yet been made as to when or where this work will be started.

▶ Also in the Cooke district, J. J. Robertson, representing Denver and English capital, is reconstructing roads to his properties on Scotch Bonnet Mountain near the head of the Clarks Fork of the Yellowstone. It is reported that a milling and power unit will be constructed immediately, and much of this equipment is reported to be in shipment to the property.

▶ At the Homestake mine of the Yellowstone Gold Mining Company, H. Kramer has a small crew reopening the workings preparatory to shipping high-grade base ores later in the summer.

IRON COUNTRY

Operations Continue At Low Rate

Stocks of iron ore at Lake ports held ample for substantial increase in rate of steel production

▶ Not much change has been noticed in the operations of the various mining companies on the Mesabi range during the past month. The last advice from steel centers shows that the steel-ingot rate has moved steadily upward to the week beginning Aug. 8 to 39.4 per cent, from 26.1 per cent for the week beginning May 30, and the low of 22.4 per cent on July 4th week. Wage rates remain the same as last year.

▶ Iron-ore consumption by blast furnaces for June was low and amounted to 1,471,000 gross tons, according to the Lake Superior Iron Ore Association. This compares with 1,711,146 in May, and 4,639,733 tons in June, 1937. The stocks of iron ore on hand at Lake Erie as of July 1 amounted to 34,329,233 tons, compared with 24,953,835 tons July 1, 1937. Regardless of the pick-up in the steel-ingot capacity, it is doubtful whether shipments will exceed 20,000,000 tons in the Lake Superior district, as the season is late for any pick-up in the steel industry to help the mining activity on the Mesabi range.

▶ Republic Steel Corporation is not operating any of its mines, and the most active mine of Pickands-Mather is the Mahoning, which is loading steadily. The Danube and Scranton mines of Pickands-Mather are also operating on restricted schedules.

▶ Cleveland-Cliffs Iron Mining Company is operating three 8-hour shifts per day, four or five days a week, at the Canisteo mine, Coleraine, in Minnesota. Some of this ore is being stockpiled and the rest is being shipped to the ore docks at Superior.

▶ Charleson Iron Mining Company is doing a little shipping from the Judd mine, at Taconite, Minn., and the Dale mine, at Hibbing, Minn. The Pacific mine, at Aurora, Minn., operated by this company, is idle.

▶ A scheme is on foot to ask the Reconstruction Finance Corporation to finance the construction of a pipe line from southwestern Kansas to the Mesabi iron range to supply the mining district and other points in northern Minnesota with natural gas. This is being fought vigorously by the coal interests and by labor organizations throughout the district.

▶ A meeting of the executive committee of the National Safety Council was held in Duluth on Aug. 5 at the Hotel Duluth. A motor trip will be made to the iron mines at Hibbing and other Mesabi range points on Aug. 6.

▶ The Engineers' Club of Northern Minnesota and the Engineers' Club of Duluth held a stag meeting at Esquagama Lake on July 23.

A MODERN PACKING
FOR PRESENT-DAY CONDITIONS

"PALMETTO"
REG. TRADE MARK
PACKING

Has no equal for Long, Economical Service under STEAM (HIGH PRESSURE AND SUPERHEATED) and COMPRESSED AIR

Made from the highest-grade, longest-fibre Asbestos obtainable.

Built up with a layer-upon-layer construction, giving greater strength than when made of rolled-up asbestos sheet.

Each single strand is thoroughly lubricated with a specially compounded lubricant *before* braiding.

The result is a packing that lasts longer; therefore, worth more, as it costs less in the long run. Length of life in service is the only true basis on which to determine the actual cost of a packing.

Send for A B C Chart of Services. Also Free working sample. State size of packing used and conditions of service.

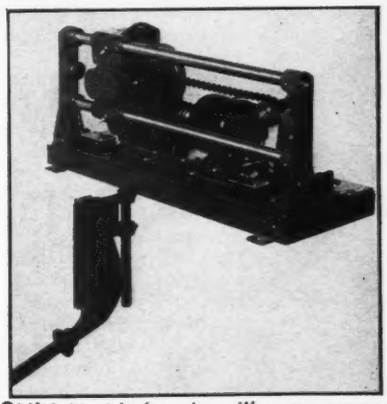
GREENE, TWEED & CO.

Sole Manufacturers
109 Duane Street
New York

Canadian Agents—
The Canadian Fairbanks Morse Co., Ltd.

Montreal, Ottawa, St. John, Toronto, Winnipeg, Calgary, Saskatoon, Victoria, Vancouver, Regina, Edmonton

GECO Automatic Sampler



GECO Electric Sampler with cover removed

For accurate Fully controlled Sampling

TECHNICAL control of plant operations is only possible where an efficient system of sampling is rigorously followed. In continuous operations, products must be sampled as they flow and at regular intervals to obtain samples that are truly representative of the material in process.

GECO SAMPLER installations represent a wide range of applications that are daily proving their dependability and accuracy of operation.

Send for Bulletin No. 702 to-day.

The GENERAL ENGINEERING CO.
159 Pierpont St. Salt Lake City, Utah
Toronto New York London

NEWS FROM Washington

By Special Correspondent

BUSINESS is fundamentally better. This is the general conclusion in Washington. Many have reached it by wishful thinking. But some real evidence is offered that is important to the mining industry.

1. Housing demand has made itself felt with a continuing substantial new construction program. New Dealers would like to take credit for the Administration. But regardless of credit, the fact of enduring construction betterment seems proved.

2. Farm income continues very close to last year's total, despite distressing prices for certain commodities. This means good farm buying power, good markets for many things, including machinery, automobiles, and other metal products.

3. Wage rates have held up very well. Cuts thus far have been largely on salaries, not greatly affecting buying power of those who have a job.

4. Reemployment evidence accumulates, although no boom is in sight.

5. Big industry is not too pessimistic —automobiles, for example. Folks engaged in such a business usually guess right on prospective markets.

6. Wall Street has been happy. This means nothing in fact, but is psychologically important, because—

7. Big executives are taking some longer chances on new developments, apparently largely the result of their own stock-market experiences. (So Washington reasons.)

The major sour note is the railroad situation. But Washington has concluded that with relatively few exceptions bankruptcies need not come immediately. A modest increase of loans for equipment will probably carry their buying power through the summer and fall pretty well above spring expectations.

All this is important to mining mainly because it shows the basis on which official plans are made. Most important of those plans is the continued rapid spending of all relief and other Federal funds, so that every bit of pump-priming impetus that can be had will count soon. Even though the motive may be political, the good business effect remains.

On 64c. Silver

THE TREASURY ANNOUNCED on July 21 that the mints have been authorized to purchase all newly mined domestic silver mined prior to midnight Dec. 31, 1938, on the basis of 64.64c. per ounce. The question has arisen as to whether domestic silver mined prior to midnight of the last day of the year may be received after that date, the official statement read, and it was pointed out that normally a considerable period of time elapses between the date silver is mined and the date when the refining of the silver has been completed. Under the ruling of the Treasury, silver producers in this country will receive the price established for 1938 on metal mined up to the end of the year.

A similar announcement was made last September in reference to the 77.57c. price then in force. At that time silver producers felt that the announcement pointed to a downward revision in the buying price at the end of the year. On Dec. 30, 1937, President Roosevelt signed a proclamation establishing the price on newly mined domestic metal for 1938 at 64.64c.

Production of silver in the United States so far this year has been in smaller volume than in the same period last year. The reduced output has resulted chiefly from the lessened rate of activity in base metals, as silver, in large measure, is a byproduct metal. Production in the first five months of 1938 was 25,914,000 oz., according to the American Bureau of Metal Statistics, which compares with 26,573,000 oz. in the same time last year.

Strategic Minerals

CONGRESS did not approve the idea of building a strategic mineral stockpile, as explained in *E.&M.J.* last month. This greatly disappoints the technologists of the Bureau of Mines who wanted to start new researches on development methods which might apply to such reserves. It even more disappoints the economic investigators who were instrumental in formulating the bill that seemed so likely to pass three months ago. Without the large sums proposed for these metals, new field studies are being considered along the old conventional lines.

Tungsten studies are contemplated because some Washington officials believe that the present situation with respect to this important alloying element is worse that it has ever been before. Increasing demand has far outrun production possibilities. New developments have been useful and significant. During bad business conditions they have obscured the inadequacy of domestic supplies, some officials believe. These men argue that if we were to have a good business period of two or three years, we would discover that the United States could not supply its own tungsten needs *regardless of the price* which industry might be willing to pay.

Quicksilver developments have been explored also from an economic point of view. Tentative interpretations indicate: Arkansas was more or less a flash in the pan. Oregon might supply some quicksilver, more at a high price. California has proved most dependable thus far. But one area of four square miles in northwestern Nevada is now the most promising quicksilver source in sight. The Bottle Creek area may be the big supplier in the early future. These are unofficial conclusions, but quite significant of official thinking.

All of the departments interested in strategic metals expect to put their full influence back of the mineral stockpile legislation in the next Congress.

Patent Limitations

ANTI-MONOPOLY investigators plan to make their patent studies a major part of the summer program. They have fully adopted the philosophy of Robert Jackson that patents are often used to foster monopolies. The former Assistant Attorney General sold this idea to the President, who made it an important part of his anti-monopoly message to Congress. Now comes the special subcommittee of the Monopoly Inquiry to attack the subject.

This phase of the investigation will be directed by Assistant Attorney General Thurman Arnold, which ensures a vigorous and critical, but essentially a fact-finding, type of study. Mr. Arnold says that he does not want this effort to be punitive in nature. But he does make it clear that he thinks for the future there should be careful consideration as to whether a seventeen-year life for patents is not too long, especially when a patent is not worked.

The Washington discussion revolves around the idea that many companies get an excessive period of protection for their patent rights by getting improvement patents or by allowing patent matters to drag for years in the Patent Office. Corporations are also charged with buying up patents merely to suppress them. The use of litigation over patents as a means of tying up or scaring off smaller prospective competitors will be studied.

Even the most ardent of the investigators declines to forecast just what sort of legislation will be recommended. But it is reasonable to expect that some definite legislation, which will have the status of an Administration bill, will be introduced into the next Congress restricting the life or the scope or the effectiveness of patent control by industry.

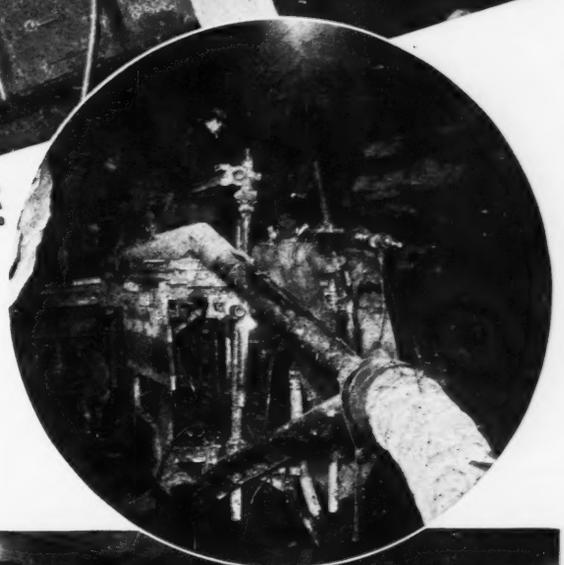
Mobile Mining

THE CONTEST between improved technology and increased natural difficulty of mining constantly attracts the attention of official Washington. During recent weeks there have been a variety of evidences that this subject largely affects the thinking and the policy making which through regulation or law may become an important factor in governing this industry.

Great emphasis is placed by the Bureau of Mines on the mobility of mining equipment which has been developed recently. Dragline equipment is cited as an important example of the adaptability of field equipment to large-scale operation with progressive relocation as needed. One such Western unit was described by some officials with great enthusiasm. This particular dragline installation handles up to 100,000

COMBINING DUST COLLECTION and EXHAUST VENTILATION IN WET DRILLING OPERATIONS !

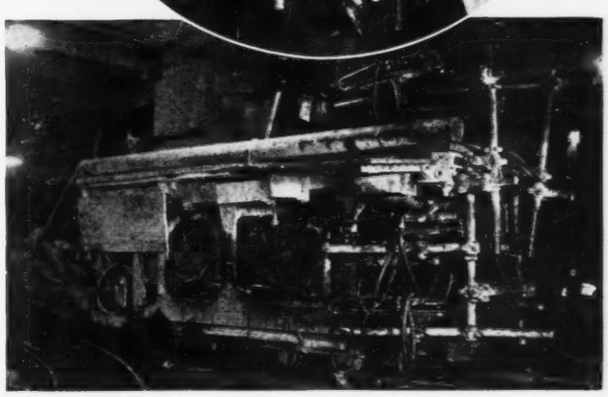
One of the Type W Roto-Clones used in constructing the 6th Ave. Subway, N. Y. C., providing exhaust ventilation of 10,000 C.F.M. and precipitating the dust in one operation.



CONSTRUCTION of the 6th Avenue Subway in New York City developed another application for the Type W Roto-Clone Dust precipitator—collecting hazardous dust particles and maintaining a safe limit of dust concentration—in connection with wet drilling operations.

The Type W Roto-Clone is equally well suited and widely used for the control of siliceous dusts from screens, transfer points, elevators, crushers and other dust producing equipment.

Performing the functions of exhauster and dust separator in a single compact unit, the Type W Roto-Clone collects the lightest and finest dusts by the scrubbing effect of water sprays combined with the proven principle of dynamic precipitation. The collected dust, delivered in the form of sludge or slurry is easily disposed of without creating a secondary dust problem. **Bulletin No. 274 will be sent free.**



"Jumbo" drill carriage
In circle . . . Rear view, showing duct connections to Roto-Clone

AMERICAN AIR FILTER CO., INC.
113 Central Ave., Louisville, Ky.
In Canada: Darling Bros., Ltd., Montreal, P. Q.

ROTO-CLONE
WATER SPRAY DYNAMIC PRECIPITATOR

cu.yd. of material per month, despite the fact that relocation of the unit almost daily is essential.

The social and labor significance of this sort of thing is also emphasized by the investigators of the National Resources Committee. They have pointed out in their recent tome on population that employment in mining is not likely to decrease because of efficiency. They figure that this improved technology is barely able to keep up with the increasing difficulty of getting ore out of the ground. Thus, total employment in mining is, according to their philosophy, not going to decrease but will be about constant.

Technologists in Washington are also emphasizing the advantage in a number of cases of using alloy steel and other new high-strength materials. In some cases it is noted that long haulages or hoisting from great depths would hardly be practicable if the modern special alloys furnished by the metallurgist were not available.

Mines vs. Fish

VETO BY THE PRESIDENT of the stream pollution bill passed by Congress defers settlement on a national scale of the growing controversy between the mining industry and fishermen, led by the Isaac Walton League. But certain State laws, notably the new California débris law which took effect July 1, give great advantage to the fishermen in this controversy. Officials in Washington are surveying this situation with respect to the mining industry, and have reached some rather important conclusions.

The case of Colorado is an interesting one. It is estimated that this year tourists from outside the State coming for vacationing and fishing will leave between $80,000,000 and $90,000,000 in the State. This sum is greater than the total mine payrolls of the State. It makes the business men and the legislators very conscious of the importance of protecting primitive areas which are the attraction that bring the money spenders into the Commonwealth.

Engineers of the Bureau of Mines are wondering whether this zeal for undisturbed nature may not actually prevent much of the hydraulic mining and even the modern chemical flotation operations. There is no doubt that both these types of mineral industry may interfere with the natural purity of streams and the fish life there.

Apparently it was reasoning of this sort which made California compel the shutdown of large numbers of mineral operations from the first of July until the first of December. Instead of a closed season for fish, we now have a closed season for mining.

News "Fines"

Silver Buying—The Treasury will continue to purchase Chinese silver at least through August. Secretary Morgenthau implies that this source of bullion will add monthly about $10,000,000 worth of silver to the Treasury reserves.

Magnesite Tariff—In making a trade agreement with Venezuela, Secretary of State Hull announces that the tariff on caustic-calcined magnesite and on dead-burned magnesite will both be open to discussion and possible reduction under the flexible tariff policy. The only other mineral products to be considered in these negotiations, so far as yet announced in late July, are petroleum and petroleum products.

Phosphate Leases—No more leases will be granted for mining of phosphate on the public domain, under a decision of July 11 by Secretary Harold Ickes. This action, the Secretary explains, is to prevent further depletion of the phosphate-bearing lands controlled by the Government until a new policy can be established by the Congressional committee which is investigating these matters this summer, under the chairmanship of Senator Pope of Idaho. This is another outbreak of the philosophy (largely erroneous) that the United States reserves of phosphate may be exhausted within relatively few years.

Why a Veto—The President vetoed the stream-pollution bill as passed by Congress despite almost unanimous support for this conservation measure. He argued that the recommendations under the law by the Public Health Service should not go direct to Congress but should go instead to the Chief Executive to be worked in as a part of the general budget program. This deep concern for the budget system causes cynical comment in Washington when contrasted with the recent forecast of a $4,000,000,000 deficit next year. Political, and not economy, motives are therefore charged as the real basis of the veto.

Who is a Miner?—Officials in Washington wish they could find how many folks who really intend to prospect or mine on their claims really wanted President Roosevelt to sign the bill which suspended annual assessment work. These officials claim that all the real prospectors and the real miners are against this action. They claim that it is the small-town merchants, and others with no serious mineral intentions that are politically responsible for such legislation. One official even goes so far as to say, "I have never been able to find a real prospector who thought such suspension of assessments was justified."

Strike Breakers—It is now a Federal offense to travel in interstate commerce and participate in an industrial controversy in which violence or public disorder takes place. Thus an official who may go from the home office to a mining property to assist in policy decisions during a strike theoretically might go to the Federal penitentiary if some rioting broke out while he was there. The law also seems to apply to labor union executives and those seeking to advance the cause of labor. Washington does not expect rigid enforcement on either side. But the law may give a basis for restricting movement of strike breakers, since even the travel by an individual to become a strike-breaker seems to be forbidden.

Chalk Creek — Government men would like to have careful exploration made, in fact are proposing a survey, of the complex ore in the Chalk Creek area of Colorado. This refractory ore containing about fourteen useful metals seems to represent a worth-while reserve that could be worked out now that gold sells for $35 an ounce. However, it might be difficult to mine the area effectively without contaminating trout streams. The political significance of this is not clear.

Cost of Gold—Recent field conferences of some of the Bureau of Mines men seem to indicate that very few small gold producers are really making a profit. A few of them know their real costs; most of them make bare wages. But, as one comment goes, "Even that is better than uncertain relief money."

Steel Wages—Some Washington critics think that a sudden outburst of activity with respect to Government purchases of steel has an ulterior motive. The Department of Labor during July started negotiations to determine what minimum wage rates should be fixed for companies planning to sell steel to the Government under the Walsh-Healey law. It is charged by some industry spokesmen that this is an attempt to prevent cutting any wages below 62c per hour for common labor, the present typical steel rate.

Spanish Mineral Control

WASHINGTON OFFICIALS have noted with interest and some concern a form of peaceful penetration into Spain that does not seem to have had much industrial attention. The military disturbances between Franco insurgents and the Loyalist party have rendered inconspicuous the large invasion of German technologists into Spain, apparently an organized plan of the Nazi Government.

Some official observers believe that Hitler has authorized a definite program which will insure Nazi managed industry on the Iberian peninsula. Much of the effort is to secure control of mineral resources and the processing of these for German supply of metals and nonmetallic raw materials. This is very logical, as one official put it, "because Spain has probably the best balanced and most complete mineral supply of any European area under single political control." As evidence of this are cited the abundant supplies of iron, sulphur, quicksilver, copper, lead, zinc, tungsten, magnesite, and a large number of other mineral commodities needed by German industry. Some of these supplies might not be needed if the Eastern Corridor program of Hitler were fully developed. But the Czechs are likely to delay that eastward movement long enough to make Spanish exploitation important now.

It is even forecast by some who have looked into the situation quietly that some of the so-called worked-out lead areas may be revived. Properly mechanized, and with scientific administration, such mines could be operated, although formerly thought obsolescent if not actually obsolete. German thoroughness in technical and scientific matters is expected to supply the needed aid.

Recent Labor Angles in the Non-ferrous Metal-mining Industry

July 1, 1938—The National Labor Relations Board today ordered **Sunshine Mining Company,** Kellogg, Idaho, engaged in silver mining and milling in the Coeur d'Alene mining district in Idaho, to offer immediate reinstatement to about 275 striking employees, with back pay, less earnings from August 18, 1937. Also included in the Board's order are requirements that the company bargain collectively with International Union of Mine, Mill and Smelter Workers, (C.I.O.), as exclusive representative of its mine and mill employees, and to disestablish the Big Creek Industrial Union, an unaffiliated, company-dominated organization. Evidence before the Board revealed that the unfair labor practices committed by the company included interference with union activities through circulation of a petition relative to the method by which strikes should be called; refusing to bargain collectively with the affiliated union despite its majority status, thereby precipitating a strike called by the union; using unlawful methods to break the strike; discriminatorily denying reinstatement to the strikers by making acceptance of applications of striking employees for reinstatement conditional upon the approval of a group of anti-union employees; and forming a labor organization, following the strike, to combat the union. The strike was begun by the union on August 1, 1937, following refusal of the company to deal with it as the exclusive bargaining representative or to enter into a written contract, and continued until August 8, 1937, when it was broken. Applications of strikers for reinstatement, about 60 of which were made on August 18, 1937, were referred by the company to the Committee of 356, which the company had formed on July 30, 1937, to combat the strike. The committee's action on each application was determined by whether the striker had engaged in picketing during the strike. The Board ruled that all the striking employees were entitled to be recompensed for their wage losses as well as to be reinstated to their former positions.

July 19, 1938—The Ninth Circuit Court of Appeals decided that **Idaho Maryland Mines Corporation,** a gold producer, in Grass Valley, Calif., does not come under the jurisdiction of the National Labor Relations Board. The Court decision means that the corporation is not obliged to reemploy about 75 men laid off after the closing of the Old Brunswick mine about a year ago. Also involved was the Board's order to the corporation to cease coercion of employees in right to organize, cease domination and interference with and financial support of a union the Board found to be company inspired. The board also ruled that the company is in interstate commerce, because supplies used by the company have come across State lines, and the gold sold the San Francisco Mint is subsequently shipped to Denver. These assertions were ruled out by Judge Clifton Mathews (Judges Curtis D. Wilbur and Francis Garrecht concurring) when he said: "It (the company) buys nothing, sells nothing, ships nothing and nothing is shipped to it, in interstate or foreign commerce." —"We regard such shipments (of gold from San Francisco to Denver) as purely governmental administrative acts." Cited to support the Circuit Court's decisions were decisions of the United States Supreme Court in the Jones and Laughlin case, the Santa Cruz Packing and Carlyle Lumber Company cases.

July 26, 1938—Because supervisory employees of the **Tennessee Copper Company,** Copperhill, Tenn., intimidated and coerced employees to vote for the American Federation of Labor in an election held March 18, 1938, in a contest between that organization and the International Union, Mine, Mill and Smelter Workers (C.I.O.), the National Labor Relations Board today set aside the earlier poll and ordered a new election. The new election will be held within 20 days of the election order among all employees of the company in the Ducktown basin who were on the company's payroll as of November 19, 1937, excluding clerical and supervisory forces, chemists, technical engineers, and those who have since quit or have been discharged. First balloting resulted in 543 votes for the A. F. of L. and 488 for the Smelter Workers, with 12 voting for neither, and four votes blank, void or challenged.

July 24, 1938—The Atolia Mining Company, a tungsten producer, in Atolia, Calif., received notice from the National Labor Relations Board that the Atolia Employees Association, Local 21,464 of the American Federation of Labor, has been recognized as sole bargaining agent for the 30 employees of the company.

▶ In a list of recent elections conducted by the National Labor Relations Board, is announced the result of one held on June 28 at the **Consolidated Coppermines Corporation,** Kimberly, Nev. The result was 168 for C.I.O. and 167 against.

Findings of the SEC

Securities and Exchange Commission has taken the following actions of interest to the mining industry.

Austin Silver Mining Company, Nevada. Stop order suspending effectiveness of registration statement, issued July 13, 1938. (This decision by the SEC does not affect those shares sold to the public under a prior registration statement and traded on the New York Curb Exchange.)

Unity Gold Corporation, Montana. Stop order suspending effectiveness of registration statement, issued July 19, 1938.

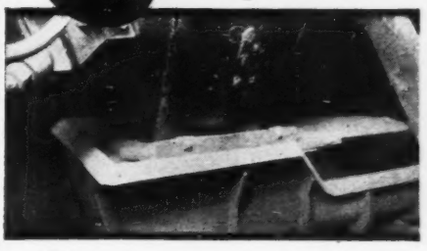
SYNTRON VIBRATORS AND FEEDERS

Save TIME, LABOR and MONEY

FOR AMERICAN ZINC, LEAD AND SMELTING!

Syntron Vibrator operating on tank from which Cottrell precipitation dust is fed to agitators in thickener plant.

Syntron Vibrator feeding electrically precipitated dust, following zinc ore roasting, to Dorr thickener operations.



● These modern machines are among the most important factors contributing to unusually high efficiency in American Zinc's smelting plant at East St. Louis.

Electrically precipitated dust from roasting furnaces falls into recovery tanks and is then conveyed in all-metal housings to agitators and thickeners. Both dust recovery and feeder tanks are equipped with Syntron vibrators.

Formerly it was necessary for men to pound the metal tanks with hammers to keep dust from sticking to the sides as it traveled to the conveyor feeders. This time-consuming and annoying problem has now been successfully solved with Syntron Vibrators.

There is also a Syntron vibrating feeder handling precipitated dust for efficient feed to Dorr thickeners, where uniformity of speed is highly important.

***WRITE TODAY* for our latest bulletins on SYNTRON VIBRATORS and VIBRATORY FEEDERS and their efficient application in the metal mining field.**

SYNTRON COMPANY

510 Lexington Avenue

Homer City Pennsylvania

Here's a pump which cannot ever be "flooded out"— because both the motor and the pump operate submerged in water. Ideal for mine unwatering, station service, or water supply. You can secure details from any BYRON JACKSON dealer (index in back) or from BYRON JACKSON CO. at Berkeley, Salt Lake City — or Los Angeles.

Just say: "tell me about...

BYRON JACKSON SUBMERSIBLE

COLORADO

Treasury Tunnel Resumes Ore Production

Operations suspended in April by fire—New custom ore mill completed near Telluride—Work begins at Tomboy mine

▶ Frank Eichelberger, president of the San Juan Metals Corporation, is again starting the operations at the Treasury tunnel, which is on Red Mountain about halfway between Ouray and Silverton, Colo. This property was closed on April 14, after a fire destroyed the blacksmith shop at the tunnel entrance. Robert Martin, superintendent, states that the underground work has been contracted to Roy Caldwell. The mill has been running intermittently on dump ore for several weeks. The Sullivan rocker mill, which was in operation at the Treasury mill for experimentation while developing a new principle in grinding ore, has been sent to Salt Lake City for changes.

▶ The famous Tomboy mine has resumed operations. John Moore recently obtained possession of the property, and immediately started cleaning out the tunnel and retimbering. This property is in Bridal Veil basin, above Telluride. The Tomboy and Montana are developed to a depth of 2,400 ft. and the Argentine property is developed to a depth of 2,200 ft. The ore contains gold, zinc, and galena, and yields approximately $10 in gold.

▶ A new custom mill has been completed on the Suffolk site near Telluride and about 100 ft. down the stream from the old mill. Sam Richards is superintendent, and William Warner is in charge of the mill. The plant will treat its own ores and also custom ores.

▶ The Alta property is working two shifts in the mine and continuous operations in the mill, and shipping twelve cars per month. Superintendent Frank Allen states that the heavy expansion program will double the payroll.

▶ The following is a tabulation of ore treated at the Golden Cycle mill during the first quarter of 1938:

Month	Tons	Average Value	Gross Value
January	45,113	$10.46	$472,135
February	40,596	12.35	501,919
March	40,576	11.10	450,492

▶ Rich ore is still being found in the Cripple Creek district. Recently a shipment from the Wilson claim, leased by the Gold Bullion Company, brought $143.81 per ton in a carload lot.

▶ The activities in the districts of Empire, Dumont, and Trail Ridge are on the increase; the dumps of the Seven-Thirty are extensive and are being worked over and run through the Mendota mill. Joe Kotich, of Georgetown, and George Clements, of Denver, have taken over the Exchange group of mines on Leavenworth Mountain, and are putting in new machinery. A new company is reopening the Metropolitan mine, in Spring Gulch.

▶ Gold Ridge Mining Company has completed its mill at the Clay County mine, in Lake Gulch. Percy Alsdorf is in charge of operations.

▶ C. A. Staley, Jr., has opened a 75-ft vein in the Livingstone mine, at Sugar Loaf. H. M. Gregory and associates took out a high-grade pocket in the Poorman mine; Elmer Wetzer and Bill MacKenzie are developing a low-grade deposit above Soda Springs, known as Kind No. 2.

▶ The Centennial electric dredge, working at Breckenridge for many months, is being dismantled and moved to the Placers Realty grounds at Fairplay. Dredging will start some distance below the springs and continue up Beaver Creek to Poor Mans Gulch. For weeks the ground has been drilled, bedrock being found as deep as 50 ft.

▶ The mine tailings dam in the South Platte River at Fairplay, Colo., has been completed by the Colorado State Mineral Resources Board. From all appearances the dam is working successfully. It is filtering the water and dropping the heavy material behind the dam. Samples taken below the dam reveal a much smaller percentage of solids than allowed by the ranchers.

▶ Alma Syndicate, Inc., has resumed operations at its property in Mineral Park, Alma, Colo. J. L. Lansing White is general superintendent; Joseph Thibedeau mine foreman, and J. T. Spicer, mill superintendent.

▶ The Ajax mine of the Golden Cycle Corporation recently installed a new 900-g.p.m. pump on the 26th level, and that level has been pumped out. A raise is being driven from this level to connect with the 24th level. This new raise will improve ventilation to the lower levels and add to development.

▶ Golden Conqueror Mines shipped 76 cars of ore in June. This increased production was made possible by the installation of new equipment in the Burns shaft of the Free-Coinage-Findley group.

MICHIGAN

Production Starts at Isle Royale Mine

Property closed for several years joins list of Lake copper producers—Geological survey under way in Houghton County

▶ The Isle Royale, closed for many years, resumed production from four levels in No. 4 shaft in July, following a several months' period of rehabilitation. More stopes will be started as soon as other levels are cleaned up and equipped. Shipments to the Isle Royale mill have started. Extensive repairs have been made in the mill. Repairs to No. 5 shaft are approaching completion and mining in this branch will soon be started. A total of 135 men is employed at the mine, and more will be added as soon as places can be made for them. It is estimated that between 20,000,000 and 30,000,000 lb. of copper is available for

stoping when the mine is completely cleaned out. Reopening of Isle Royale gives the district four operating companies: Calumet & Hecla, Copper Range, Quincy, and Isle Royale.

▶ A geological survey of the southern part of Houghton County to trace copper-bearing lodes and attempt to locate favorable areas for exploration has been authorized by the geology division of the Michigan Department of Conservation. The survey is intended to bring geological reports on the areas up to date, present data not having been revised for many years. Geological students and professors are employed by the division. The work will go on through the summer.

TRI-STATE

Several Mines and Mills Reopen

Production schedules continue on a reduced basis but employment increases and districts are encouraged by improved outlook in zinc industry

▶ The increased prices for zinc and lead in late June and early July caused several mines to open so that by late July production of zinc concentrates had increased to over 6,000 tons per week. If the major companies continue to operate on a half-time schedule through August, zinc production for that month will average about 5,500 tons per week. Shipments have approximated production during July so that stocks of concentrates in bins have remained unchanged.

▶ The reopening of several mines and tailings retreatment plants during July has given employment to between 700 and 750 men. Future concentrate prices will determine whether some of these operations will continue on a full-time schedule.

▶ Mine operators are giving serious consideration to the 44-hour provision of the Fair Labor Standards Act. It will probably cause most of the mines to operate on a 5-day week schedule for it will be impractical to work swing crews among the drillmen.

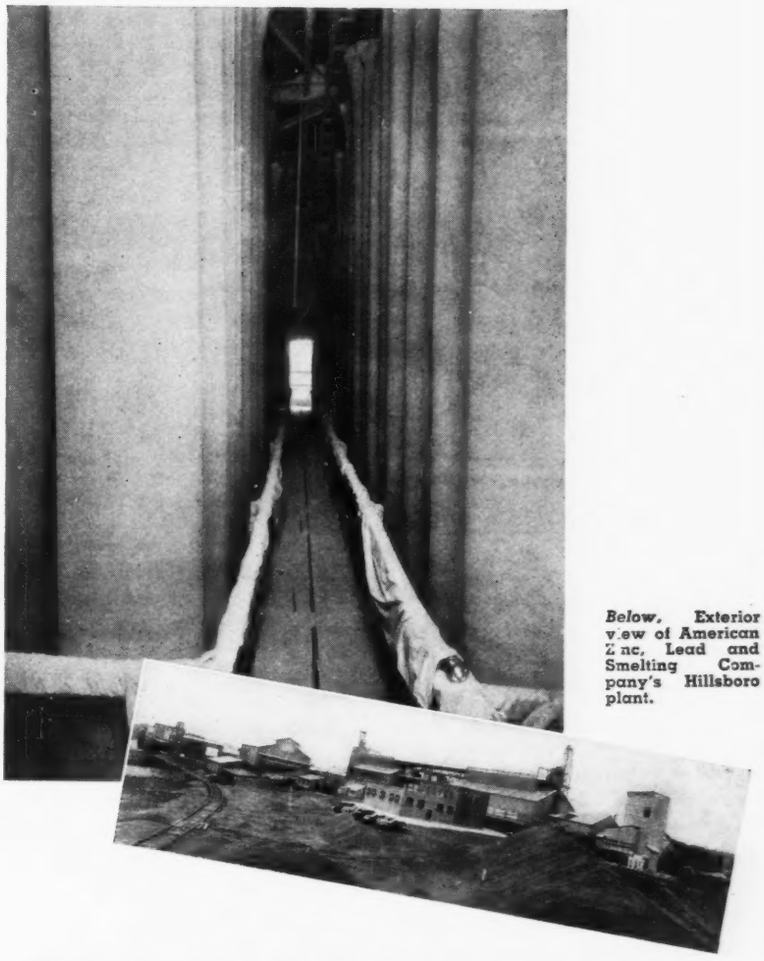
▶ The Anna Beaver tailings retreatment mill of the Commerce Mining and Royalty Company was reopened late in June after a month's shutdown. H. W. Harrison is general manager for the company and Elmer Isern metallurgist.

▶ The Rialto Mining Corporation reopened its mine and mill early in July. A mixed feed of mine ore and tailings were first treated, but the mine was later shut down and tailings only are now being treated. Sam Ashe is secretary and in charge of operations.

▶ The Captain Milling Company placed its mill in operation the middle of July retreating tailings from the Bendelari lease of the Eagle-Picher Mining and Smelting Company. This mill, with a capacity of 100 tons of tailings per hour, is one of the largest tailings retreatment mills in the district. The Anna Beaver

★ PENDLETON WOOLEN FLUMES STAND HOT ZINC OXIDE ★

In the baghouse of the American Zinc, Lead & Smelting Company's Hillsboro plant



Below, Exterior view of American Zinc, Lead and Smelting Company's Hillsboro plant.

THE INSTALLATION of Pendleton Woolen Bags or Flumes to withstand the hot oxides recovered from the zinc ore retort furnaces in this plant is typical of the great variety of adaptations to which Pendleton products can be applied. The excellent wearing qualities of the 32½ ft. by 18 in., woolen flumes supplied by Pendleton represent a long technical and practical experience back of this product for successfully meeting such severe service conditions.

If you have any need for woolen products or are interested in their modern possibilities and advantages as a beneficial means of saving or of increasing production—write us. Our laboratories and technical advisors are qualified to help you in any of your problems.

PENDLETON WOOLEN MILLS

WASHOUGAL, WASHINGTON

▶TRI-STATE

mill of the Commerce Mining and Royalty Company has the same capacity. W. Ellison is mill superintendent.

▶ The mines and mill of the Lawyers Lead and Zinc Company were reopened early in July. The property had been down since April 1. The mill treats a mixed feed of mine ore and tailings. G. O. Pearson is company manager.

▶The Barr mine and mill of the Vinegar Hill Zinc Company were placed in operation early in July after being down since March 31. The mine will operate one eight-hour shift and the mill three eight-hour shifts daily. J. G. Trewartha is general superintendent.

▶ The Dines Mining Company, Inc., dewatered its mines on the Blue Mound and Southern leases and placed them in operation together with the mill on the Blue Mound lease late in July. The ore from the Southern shaft will be trucked to the mill, a distance of two miles. J. P. Dines is president and manager.

▶ The mine and mill of the Sunflower Mining Company, Inc., which were closed down on March 28, were reopened late in July. Howard Thomas is superintendent.

CANADA

New Tax Threatens Mining Industry

Capital gains levy looms before metal producers, exploration companies, and syndicates—Drilling at Waite Amulet indicates greater possibilities for a substantial copper deposit—Mercury production scheduled in British Columbia

▶ A few hours before adjournment on June 30, Parliament tossed a bombshell to the Canadian mining industry in the form of a tax bill that threatens to levy a revenue in excess of the total value of company assets consisting of stocks, bonds, and other securities. This makes exploration companies and syndicates liable to income taxes on the shares of other companies when these are distributed; the individual shareholder who receives the stock is also forced to turn over a generous slice to the Ottawa authorities. All this is brought about on the theory that distribution of stock is the same thing as a sale, and the Government feels it has been missing a trick in staying out of such transactions. One of the unfortunate angles of this, which observers believe is the worst legislative blunder since the miners were hit with the bullion tax, is that much of the stock on the inventories of holding companies represents a total loss. The new bill is retroactive to 1936 and a case has already appeared where Northern Canada Mining Corporation has been assessed $3,482 in back taxes on a block of Nordarm Long Lac stock which has no value. Northern Canada took an actual loss of $60,000 when it explored the Nordarm claims, and was left with 300,000 shares. This the assessor now decides has a value for tax purposes of $23,217. Read-Authier is in a particularly bad spot and has canceled plans for distributing Sigma and Lamaque stock to shareholders to avoid new taxes estimated at more than a million dollars. Two or more of the individual shareholders would have to pay more than 70 per cent under the new bill. The Minister of National Revenue sets an arbitrary value on the stock and there is no appeal from his decision. This looks like the Dominion's first threat of a capital gains tax, a threat real enough to put several hundred mining companies "through the wringer."

▶ According to an independent report by Futerer and Reid, consulting engineers, Quebec Manitou Mines has estimated ore reserves of 252,000 tons to a depth of 350 ft. The main shaft has opened the No. 1 orebody on two levels, at 210 ft. and 350 ft., with a total of 2,962 ft. of drifts and crosscuts. The ore has been indicated as a lenticular body 400 ft. long and averaging 30 ft. wide. Values average 11.2 per cent zinc, 3.69 oz. silver, $2.98 gold, with a low copper-lead content. The shear zone associated with deposition has been traced by drill holes 2,000 ft. to the west of the shaft. Active development work is to be resumed as soon as finances are available to carry out the $80,000 program recommended.

An important mining development is taking place on the Waite Amulet where drilling has revealed an extensive copper deposit. The Waite mine in the foreground will send ore via aerial tram to the Amulet concentrator in the right background. Noranda smelter smoke can be seen in the horizon.

Quebec

▶ The new orebody at Waite Amulet appears to be gaining bonanza proportions that place it in the category with the Noranda "H" orebodies, discovered ten years ago. A dozen deep drill holes put down in the last two months have indicated upward of 2,000,000 tons of 7 per cent copper and $2 in gold and silver. Developments have been on a scale to rank with anything else found in Canada. The new ore occurs in a rhyolite-andesite contact zone 1,000 ft. below the surface, and it is believed this structure will be a guide to the location of other flat-lying lenses in the same area. Four drilling machines are now working to extend the boundaries of the great orebody to the southwest. J. Y. Murdock, president, states that current profits from the 350-ton mill that ships concentrates to the Noranda smelter will go into extended exploration. The greatest thickness of the lens yet penetrated is 165 ft. The length has been traced for 550 ft., and the indicated width between No. 5 and No. 6 holes has been increased to more than 225 ft. by the ore intersections reported on July 21 for No. 11 drill hole. Mill capacity is being increased to 500 tons to be ready in August to receive ore brought by aërial tramway from the Waite mine, two miles to the northeast.

▶ Dr. H. C. Laird, consulting geologist in charge of exploratory work on the Maniwaki property in Vauquelin Township, is continuing efforts to outline an orebody on what was regarded last year as one of Quebec's most promising gold showings on surface. Three large pits have been opened up and 26 drill holes have tested structural conditions. Although the surface values persisted across a 40-ft. width for a length of 320 ft., the vein material cannot be traced any deeper than 25 ft. More than 200 tons of rock from pits have been bulk-sampled with unsatisfactory results. The method of sampling has now been improved by installing a diesel-operated jaw crusher.

▶ The first seven months' shipments to the Noranda smelter from Powell Rouyn Gold Mines have been discussed in the annual report issued by W. R. Johnston, president, indicating steady progress in mine expansion and prospects for further increases in production. Shipments for the quarter ended June 30 averaged 390 tons daily. In May hoisting equipment was speeded up and daily smelter deliveries were increased to 500 tons. In one compartment of the main No. 2 shaft an aluminum cage and skip is used, counterbalanced by a steel skip in the second compartment. Each skip is of 2-ton capacity. With only minor

additions to the mine plant, output can be stepped up to 750 tons. G. Miller is mine manager.

Ontario

▶ Noranda Mines, Ltd., second largest copper producer in Canada, moved into first place early in July for gold output, when Hallnor Mines shipped its first bullion. Both Hallnor and the adjoining Pamour, in the east Porcupine area, are Noranda-directed enterprises, and Noranda also controls the potent Waite Amulet.

▶ McIntyre Porcupine Mines has opened up 170 ft. on the length of new ore that was recently discovered in an unexplored section of the mine 600 ft. north of the main shaft. Widths have been found up to 9 ft. Mine officials regard this development as having great potential importance. The property covers more than a mile on strike of the occurrence, which underlies a porphyry body on the 3,875-ft. level.

▶ Since tuning up the MacLeod-Cockshutt mill on April 4, the average gold recoveries have been $9.02 per ton. Costs have been held to $5.22, including heavy development expense involved in running long crosscuts on the 500- and 800-ft. levels to explore the new north ore zone about 850 ft. from the main underground workings, where stopes 40 ft. wide are being developed with satisfactory results. On the spectacular new orebody to the north, one shoot has been drifted on for a length of more than 265 ft. The grade averages $16.34 across 12.5 ft. Three other shoots have been partly explored by diamond drilling and reveal only a slightly lower gold content. This Little Long Lac producer gives promise of becoming one of Ontario's important large-scale operations.

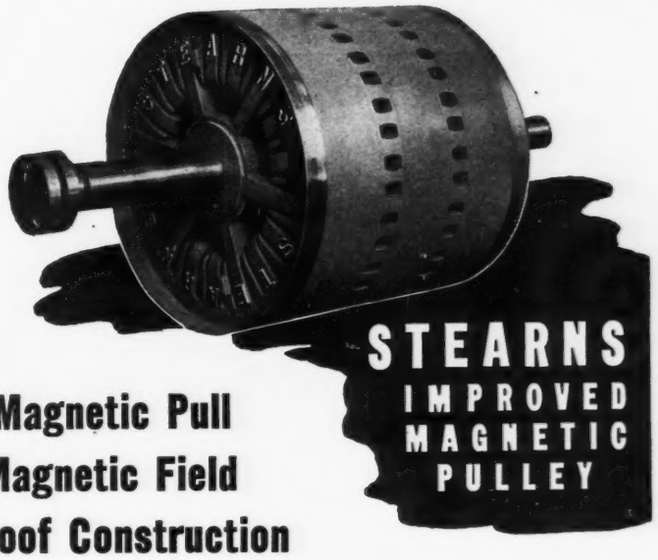
British Columbia

▶ Machinery for three new mills was delivered recently to Zeballos, the thriving new gold camp on the west coast of Vancouver Island. The 75-ton plant of Privateer Mines, Ltd., is expected to be ready for operation in September. G. S. McDonnell, the company's consultant, estimates there is ore for two and a half years' production indicated between the 600 and 1,000 levels. The second mill, of 50 tons' daily capacity, is being installed at the Goldfield mine of Spud Valley Gold Mines, Ltd., under the supervision of P. W. Racey. A small 15-ton pilot mill is also being built at the Rey Oro mine by Edward G. Brown, one of the principal owners.

▶ The Climax group of twelve claims situated on the Gold Creek side of the Zeballos camp was optioned recently by Val d'Or Mineral Holdings, Ltd., of Toronto, from Delphine Mines, Ltd., a private Vancouver company controlled by R. C. McCorkell. J. E. Hammell is president of Val d'Or. Surface exploration has started.

▶ At the Rimy group of Man-O-War Mines, Ltd., No. 3 vein has been opened at depth with encouraging results. Whereas on the surface the ore aver-

COOL
Because it's Ventilated
in operation
Resulting in longer life and uniform power



- **Greater Magnetic Pull**
- **Deeper Magnetic Field**
- **Water-proof Construction**

PROVIDING BETTER CONCENTRATION, PURIFICATION, AND PROTECTION.

Pioneers in the development of Magnetic Pulleys, STEARNS engineers worked long and carefully in perfecting this improved, ventilated, better engineered pulley. Years of experience are back of this modern pulley — years of observation of pulley performance in the field. Its design ends many service problems . . . its ability means new savings . . . its benefits are numerous. It is your answer for a better Magnetic Pulley.

USE THE COUPON — GET COMPLETE DETAILS

Investigate this better performance for yourself. We shall be glad to give you full details about this ventilated, cool performing pulley upon receipt of coupon.

STEARNS MAGNETIC MANUFACTURING CO.
624 So. 28th Street, Milwaukee, Wis.

Please send Bulletin 301 regarding the new Stearns Magnetic Pulley.

NAME.....

COMPANY.....

STREET.....

CITY.....STATE.....

SOUTHWESTERN

Will place at your command its specialized engineering staff, complete facilities, and 20 years of wide experience on all problems relating to—

METALLURGICAL TESTING AND MILL BUILDING

Southwestern laboratory ore testing is thorough and dependable. Results can be readily duplicated in mill operation. Eliminates expensive trial and error delays.

Southwestern has designed and erected plants for some of the world's leading operators. At your request it will engineer, build and equip your plant, ready for efficient, economical operation.

Write or call. No obligations whatever involved in preliminary consultations.

MANUFACTURERS OF

Ball Mills • Samplers • Thickeners • Mine Cars
Ore Feeders • Reagent Feeders • Agitators
Sand Pumps • Conditioners • Flotation Machines

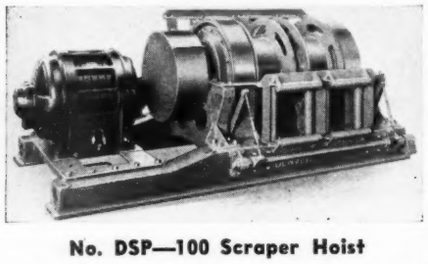
SOUTHWESTERN ENGINEERING CO.

4800 Santa Fe Avenue **Los Angeles, California**

SLASH COSTS with VULCAN DENVER

Heavy Duty—High Capacity

SCRAPER HOISTS!



No. DSP—100 Scraper Hoist

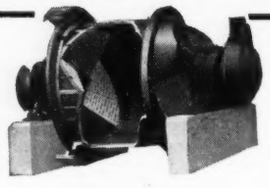
Vulcan-Denver DSP-100 Scraper Hoists are fitting into mechanization programs of some of the world's largest operators. One metal mining company installed 42 *on repeat orders* in only four years! Easily handle 5 to 10 ton payloads. Large steel drums reduce number of rope layers, rope friction and speed variation to a minimum. Provide consistent, high production. Reduce operative effort and operating costs to minimum.

Send for details and prices.

VULCAN IRON WORKS COMPANY DENVER COLORADO U.S.A. SINCE 1891

Manufacturers of Mine Hoists, Scraper Hoists, Mine Cages and Skips, Head Sheaves, Shaker Conveyors, Ball-Bearing Rope Rollers, etc.

WILLIAMSON MILLS



CUT GRINDING COSTS

By preventing slippage of the ball mass as it is being lifted, and by making the balls mix and contact more frequently as they are cascaded, Williamson Mills increase the grinding capacity of the ball charge and cut grinding costs more than 20%.

Can you afford to overlook the savings in power, ball and liner consumption that others are getting with Williamson Mills?

"It's the shape of the drum that does it"

Send for particulars and consult our engineers about your grinding problem.

WILLIAMSON COMPANY

582 Market St. **San Francisco, Calif.**

▶CANADA

aged 4.02 oz. gold per ton across a width of from 4 to 7 in., a short length of ore has been opened in the drift to date averaging 5.6 oz. across a width of 10 in. Ray A. Pitre is manager.

▶ Hedley Amalgamated Gold Mines has acquired two more properties for examination and preliminary exploration, according to W. G. Norrie-Loewenthal, managing director. A tunnel has been started at one of these, the Toquart, on Barclay Sound, west coast of Vancouver Island, to open at depth a vein traced for 300 ft. on the surface, carrying over 1 oz. gold across a width of about 1 ft. The other optioned property is the Geiler group, on Quadra Island, in Seymour Narrows between Vancouver Island and the mainland. The company is also exploring the Daylight and Victoria-Jessie gold prospects, in the Nelson district.

▶ A trial shipment of 2,000 tons of pyrites concentrate was sent to France recently by Britannia Mining & Smelting Company, and it is possible that more shipments will be made as a result of the interference of the Spanish supply by the civil war. Last year 85,715 tons of pyrites concentrate was produced at Britannia Beach, and practically all of this went to Japan. The main products, copper and zinc concentrates, are shipped to Tacoma for refining. In 1937, 2,116,075 tons of ore was milled and 32,400,253 lb. of copper produced, the average recovery being 0.76 per cent copper, indicating the low grade of ore which the company is able to mine and treat at a profit. Under the able direction of C. P. Browning, general manager, and C. V. Brennan, assistant, costs have been reduced to a low level.

▶ A 10-ton reduction furnace is being installed by Manitou Mining Company at its cinnabar property on Mud Creek in the Bridge River district, and it is expected production of mercury will start about the middle of August. The plant was supplied by the H. W. Gould Company of San Francisco, and R. F. Brown is supervising its installation. Alex Fraser is superintendent of the operation. The company's name is being changed to Empire Mercury Mines, Ltd. Its operations are being watched with particular interest, as at present practically no mercury is produced within the British Empire.

▶ Construction of the 100-ton mill at Cariboo Hudson has been delayed by the poor condition of the road, and production may not start until October. James McDonald is in charge.

▶ An average of 750 tons a day is now being treated in the underground mill at Big Missouri, in the Portland Canal district. Operations in May, the first month of production, were curtailed by a shortage of hydro-electric power, and the testing period really began on June 1. Since then the millhead has varied between 0.12 and 0.06 oz. gold per ton. Costs are estimated to be less than $2 per ton. D. S. Campbell is superintendent.

MEXICO

New Tax Will Affect Mining Industry

A 12 per cent tax on exports of metals threatens to impose handicap on all operators—Workers take over operations of Zimapan Mines and give themselves a wage cut

▶ Little improvement was found in the Mexican mining industry with the advent of midsummer. Labor trouble was still to the fore and some companies passed into the hands of their employees to run on a cooperative basis. The industry is faced with another bugbear: the recent federal tax of 12 per cent on exports which is calculated to raise 100,000,000 pesos (some $20,000,000) which the government sorely needs to purchase corn, machinery and other essentials. Several sectors of the industry are protesting this proposed impost, asserting that it would be a near death blow to mining, as their products are practically all exported. This law passed the House of Deputies and the Senate and President Cardenas signed it Aug. 5. Application of this law to the mining industry is being studied by a committee recently appointed by Cardenas.

▶ The industry has been assured by the statement by President Lazaro Cardenas that mining is not to be expropriated. Around the middle of July the chief executive said, "Do we intend to expropriate the mining companies? We do not plan this, so long as the industry is able to function without conflict, without serious conflict, there is no reason for us to intervene."

▶ Though it is reported to have discovered additional silver veins, the cooperative society that is running properties in the Pachuca sector, Hidalgo, of the British owned Dos Carlos Mining, is confronted with the problem of purchasing machinery and equipment to work the deposits. The cooperative does not seem to have immediate prospects of getting money for this equipment.

▶ Reopening of the Providencia mine, Santa Rosa district, Guanajuato, is being arranged by the owner, Alfred Chabaud. Reopening of the Santo Niño mine and mill near Guanajuato City is planned by Ernesto Brunel, the owner.

▶ A fight against expropriation of several water storage tanks at Mazapil, Zacatecas, by the national government was won by the Cia. Minera Asarco, S.A., when the federal supreme court allowed its appeal. Company argued that this expropriation on the ground of public utility was unconstitutional as the tanks are useless without pumps and other equipment the company owns.

▶ Petition to the federal labor authorities to reduce personnel and wages of retained employees of Cia. Minera de El Boleo, S.A., a French enterprise working copper properties at Santa Rosalia, Lower California, is being considered by a commission of company, workers and government representatives.

▶ Federal government sanction to conduct mines in the Hidalgo del Parral sector, Chihuahua, on a cooperative basis has been asked by employees of La Union Mining. Workers assert that this is the only way to resume operation of the property, which was closed some months ago.

▶ Mines of Cia. Minera Doce Apostles, S.A., at Taxco, Guerrero, are being run by employees for a month to obtain wages that the workers claim.

▶ Cias. Minera San Rafael y Anexas, S.A., and Zimapan, S.A., both operating in the Pachuca sector, Hidalgo, have been given in charge of their employees to conduct on a cooperative basis. The owners and the federal labor authorities were agreeable to this action.

▶ In the case of San Rafael, the workers were given charge for one year ending July 10, 1939, when they went on strike to protest a suggested 25 per cent wage cut which the company said was necessary because of depressed economic conditions, and the miners had embargoed the properties to assure payment of their compensation claims for 36,000 pesos (some $7,250).

▶ The miners took over the Zimapan properties when the owners wearied of the frequent labor troubles. These workers have agreed, however, to the proposition of executives of their cooperative that pay must be slashed in order to keep the mines going. The workers are running the Zimapan enterprise for an indefinite period.

▶ Employees have taken charge of Cia. Explotadora de la Mina Naica, S. A., Saucillo, Chihuahua, and are conducting it cooperatively as the owners quit owing to dwindling profits.

▶ Gold-silver ore is being treated on a capacity basis by the 35-ton flotation mill of Minas de Rayon, at Ocampo, Chihuahua. T. F. Friday is president and general manager.

▶ Yields averaging 10 ounces gold, 15 ounces silver and 22 per cent copper are being obtained from ore from its mines at El Arco, in the Santa Rosalia sector, Lower California, at the 50-ton oil flotation plant of Cia. Minera Anexas del Año Nuevo, James E. Harding, general manager.

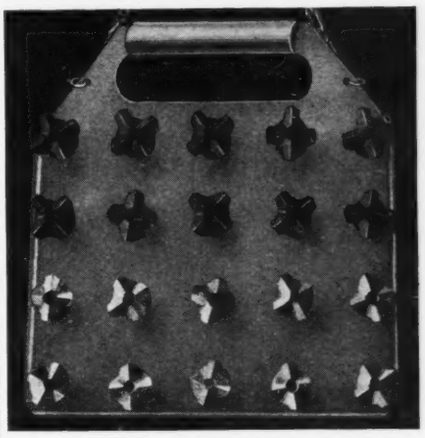
▶ On July 21, Secretary of State Cordell Hull sent a note on the agrarian controversy with Mexico, to Francisco Castilla Najera, the Mexican Ambassador to the United States. The note proposes arbitration between the two governments involving agrarian properties expropriated by the Mexican government from American citizens since Aug. 30, 1927. The note said, in part, "The representations which this government has made to the Government of Mexico have been undertaken with entire friendliness and good-will, and the Mexican Government has recognized that fact. We are entirely sympathetic to the desires of the Mexican Government for the social betterment of its people. We cannot accept this idea, however, that these plans be carried forward at the expense of our citizens, any more than we would feel justified in carrying forward our plans for our own social betterment at the expense of citizens of Mexico."

YOU CAN

☑ Stop losing bits

☑ Cut drill bit costs

☑ Get more footage per man-hour

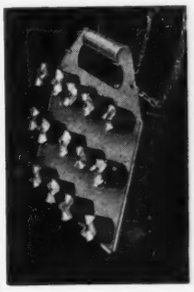


MASSCO BIT CARRIERS

(Patents Pending)

● When these filled carriers are checked out, both the clerk and the driller can see the number and size at a glance. When checked in, shortages and the condition of the bits returned show which drillers are using bits too long or not long enough and who is responsible for the bits that are lost.

● Careless handling is practically eliminated; loss in power, steel and driller's time is cut to a minimum. These savings, plus the gain in drilling footage per hour, quickly absorbs the small cost of one *MASSCO Bit Carrier* per man. Light but strong; easily changed.



AND NOTE THIS: *These carriers are equivalent to a progress record under ground. They show how much of a round is in and whether drilling is satisfactory -- a more immediate check than when the carrier is turned in.*

Send for Folder and Prices

The MINE and SMELTER SUPPLY COMPANY

DENVER, COLO., U. S. A.

El Paso New York Salt Lake City

Three days by canoe from the Atlantic coast lies the gold-placer operations of the Societe Nouvelle de Saint Elie et Adieu-Vat, in French Guiana, South America. The French Government is encouraging gold mining in its colonial possessions

SOUTH AMERICA

Gold Exploitation Program For French Guiana

Government will construct roads to remote gold areas for more active operations—Labor strike at Braden Copper settled

▶ The French Government has assigned about $3,000,000 for expansion of gold mining in all parts of the French Colonial Empire. Last year about 220,000 oz. were produced from French possessions, half of which was mined from placers by Negroes in French West Africa. Besides these Negro prospectors, there is one company in the Siguiri district which mines about 3,000 oz. yearly. In the neighboring French Congo, four companies have commenced to show an annual production around 22,000 oz. Meanwhile, geologists are prospecting different regions of French Africa. French Guiana gold deposits, in South America, have been known for the last 80 years, but a survey there never has been thoroughly carried out. Some years ago mining engineers determined gold deposits in an area about 160 miles long and about 40 miles wide. Today, however, other placers are known to lie far outside this area. Exploitation of these deposits presents numerous difficulties. The nearest known placers lie about 100 miles inland through dense vegetation and are not served by roads of any description. Present means of communication with these regions is by canoes up treacherous rivers. The population of Guiana is about one inhabitant per four square miles. Labor, therefore, is scarce and the problems of obtaining food, supplies, and transportation are difficult. Consequently, Guiana produces only about 45,000 oz. gold per year and has only two major companies responsible for the gold output, one of which has some modern equipment, while the other buys gold washed by the natives. The company mining gold is the Société Nouvelle de Saint-Elie et Adieu-Vat. It has sluices at the St. Elie placer, a distance of three days by canoe from the coast. Transport of heavy machinery to the mine was considered a work of genius, and it took about eighteen months to get the electric plant installed. St. Elie is, relatively speaking, quite near the coast. Its nearest neighbor, Saint-Pi, is over ten days inland. St. Elie occupies over 40,000 hectares and, so far, washing of only one hill has begun. Gold-bearing earth lies on the surface, and working conditions are simple, but labor is lacking. Several years ago, the French made an attempt to establish air communication with the Guiana hinterland, but this failed because enormous trees bordering the rivers—sometimes 200 ft. high—created dangerous air currents that made landing at times impossible. Recently, two French road engineers drew up a detailed project for connecting the Guiana gold fields with the coast. A great part of the newly allotted French credits will be used in realizing their project. It is believed that at least 60 per cent of the $3,000,000 will be assigned to this purpose. Another plan has also been advanced: that of dealing with the labor problem. It is intended to transport laborers from Indo-China, where the market is overflooded, and to use these for working in the Guiana mining districts.

Chile—Labor difficulties at the Teniente mines of Braden Copper Company, Chile, a Kennecott property, reached a satisfactory settlement on July 23, through intervention by President Arturo Alessandri. The President of Chile took an active interest in the strike. The company has agreed to take back discharged workers and a commission is to study the question of a wage increase at the mines.

Brazil—Several tons of copper ore will be shipped soon from the Cacapava mining district of Brazil to the United States for analysis and experiment in order to determine the most efficient means of concentration, according to a report to the Department of Commerce by the office of the American commercial attaché at Rio de Janeiro. Arrangements have been made by Brazilian geologists to have samples of the copper ore assayed at various mining universities in this country, as well as in various private research laboratories, the report stated. The Cacapava deposits, from which the copper ore is derived, belong to a Brazilian company which produces copper sulphate, aluminum and sulphate, and sulphuric acid in Porto Alegre, Rio Grande do Sul, according to the report.

AFRICA

Mining Interest Grows In Orange Free State

Witwatersrand mining companies enter field and more drilling programs are planned—High rate of gold output continues on the Rand

▶ Intense interest continues in the drilling being done by several groups in the Orange Free State to test the far southwestern extension of the Witwatersrand formations. A 10-ft. reef has just been cut by a drill put down on the Katbosch farm, 15 miles north of Odendaalsrust, assay returns of which have not yet been announced. How closely interwoven the Orange Free State operations are is indicated by the statement that Katbosch farm is a Witwatersrand Extensions property which is under option to West Rand Investment Trust, and that both Witwatersrand Extensions and Western Holdings are entitled to participation in vendors' shares and underwriting of any new company formed to work the area. Reviewing the operations in the Orange Free State at the meeting of Selection Trust (which is largely interested) A. Chester Beatty said the drilling in that region over the past few years had been "mainly discouraging, a few holes having encountered reefs which contain gold values." He added: "I wish to impress upon shareholders most strongly that when they hear of our participating in mining ventures they must not, solely on that account, take a too optimistic view."

▶ Several of the Witwatersrand mining and finance companies have acquired mineral rights in the Orange Free State

and those not already drilling are planning to begin. Lyndenburg Estates, Ltd., for instance, is to be reconstructed financially in order to raise new funds for this purpose. It owns approximately a 16 per cent interest in several areas which together cover over 423,000 acres. Geophysical surveys are planned.

▶ H. E. Barrett, government mining engineer, says the Witwatersrand gold output of 11,734,574 oz. last year compares with a previous high record of 11,558,532 oz. in 1932, when the average yield was 6.469 dwt. per ton against 4.446 dwt. in 1937. The decreased grade was due to the higher currency price of gold. Shaft sinking decreased to 36,500 ft. from 51,336 ft. the preceding year due to a number of shafts having been completed; but development openings increased from 1,958,235 ft. to 2,017,500 ft. Though the number of natives employed was larger than ever before, operations were hampered during the last half of the year by labor shortage.

▶ Rhodesia Minerals Concession is advised by its engineers to expend a further £18,000 prospecting and exploring its area, and Anglo American Corporation of South Africa will provide it with the money in the shape of a loan. Under the terms of the loan Anglo American has the right to convert into shares and is given the option to buy a limited number of additional shares at par, this being contingent, of course, on something of value being discovered.

YUGOSLAVIA

Lead Smelter Will Be Built At Zvecan

Mining companies conclude successful negotiations with Government — Zinc smelter to be erected at Sabac—Copper refinery starts production

▶ The new electrolytic refinery of the Bor Copper Mines, in Yugoslavia, was officially opened and went into commission July 2. Till now the production of this company has been sent to Germany for refining.

▶ It is announced from Belgrade that negotiations between Trepca Mines and other Selection Trust companies and the Yugoslav government have successfully terminated, and that Trepca will forthwith proceed to erect a lead smelter at Zvecan, near Mitrovica, near the concentrator, and a zinc smelter at Sabac. As previously stated, it is planned that Trepca shall absorb its associated companies, Kopaonik, Novo Brdo, and Zletovo, and then raise £400,000 of new capital by an issue of shares, the fund being used for smelter construction. Trepca milled 54,821 metric tons of ore in June, producing 6,262 metric tons of 77.74 per cent lead concentrates averaging 26.20 ounces of silver per ton, and 5,869 tons of 50.29 per cent zinc concentrates. Kopaonik has suspended production temporarily because of the low price of lead, having discontinued ore shipments to the Trepca concentrator early in June.

AUSTRALIA

Wiluna Experimenting With Smelting Problem

A clinker may be fed direct to furnaces—Amalgamated Zinc to wind up—Mt. Isa plans increased capacity

▶ The first unit of the mill of Paringa Mining & Exploration, Ltd., Kalgoorlie, Western Australia, which has a rated capacity of 50,000 tons annually, has begun operations, 2,028 tons of a head value of 6.34 dwt. having been treated during May. Present ore reserves are equivalent to over three years' mill supply, and in addition arrangements have been made to crush 500,000 tons from the Mount Charlotte leases near by.

▶ Another Kalgoorlie producer in Kalgoorlie, Enterprise Mines, Ltd., began treatment operations during May, a total of 3725 tons having been milled at the plant of Kalgurli Ore Treatment Company for a yield of 6.6 dwt. per ton. The company, which is controlled by Boulder Perseverance, Ltd., intends to treat 5,000 tons monthly.

▶ Two borehole intersections of payable ore have been made on the Happy Jack lease of Wiluna Gold Mines, Ltd. The first, which lies at a vertical depth of 1,000 ft., assays 5 dwt. per ton over an estimated true width of 26 ft., and the second, 27 ft. below it, is 6 dwt. per ton over 4 ft. Experiments in progress on the preparation of concentrates for smelting indicate that a suitable method may be the treatment, in a rotary kiln, of a slurry of concentrates and residues, producing a clinker which will be fed direct to the blast furnaces.

▶ Total profits of Big Bell, this low-grade producer, operating near Cue, amounted to £143,012 for the five months to March 31. As full-scale operation was not attained until November last, this represents about £1 per ton, a satisfactory result.

Victoria

▶ Boring operations on the property of Cocks Eldorado Gold Dredging, N. L., at Eldorado, North East Victoria, have indicated the presence of wash 30 ft. below the bottom of the lead now being worked, which is 90 ft. below surface. After boring the new wash ahead of the dredge up to the lease boundary, its extent beneath the ground already dredged will be determined and consideration will then be given to the question of reworking the area. The dredge will probably be equipped with a boom stacker for this purpose, thus enabling the pond level to be lowered so that the dredge may treat the newly discovered wash.

▶ After a lapse of some months for reorganization of plant, and latterly on account of shortage of water, Cocks Pioneer Gold & Tin Mines, N. L., adjoining Cocks Eldorado, has resumed sluicing. After a consideration of alternative methods of removing the 80-ft. cap of overburden covering the deep wash, it has been decided to effect this by sluicing, using a separate plant for this purpose.

New South Wales

▶ Directors of New Occidental Gold Mines, N. L., Cobar, N.S.W., report that discussions are taking place with other interests regarding the future of the property. This statement is interpreted to mean that another, possibly overseas group will become financially interested and that an even more progressive development policy may be undertaken.

▶ Amalgamated Zinc (De Bavays), Ltd., which was long connected with Broken Hill in the re-treatment by flotation of many hundreds of thousands of tons of zinc-bearing dumps, and which was principally instrumental in the formation of Electrolytic Zinc Company of Australasia, Ltd., is to wind up voluntarily and distribute its assets to shareholders. Funds are now largely invested in shares of Associated Pulp & Paper Mills, Ltd., a company formed to manufacture fine printings and writings from local eucalypt timber in Tasmania.

Queensland

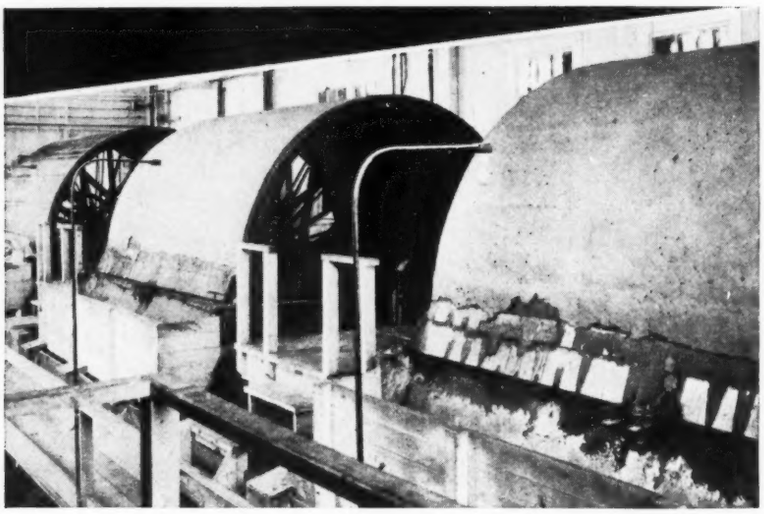
▶ Installation of fine rolls and increased ball-mill capacity are expected to increase mill tonnage at Mount Isa by about 10 per cent, according to a recent statement by Julius Kruttschnitt, chairman of directors. Mr. Kruttschnitt added that it was intended to lower somewhat the grade of ore treated, by eliminating a limited amount of selective mining that was now being carried on.

▶ Proposals for a drilling campaign at Charters Towers, with the object of locating extensions of the known auriferous reefs of the district, have been reported on unfavorably by C. C. Morton, district Government geologist, after an examination. This opinion is based on the known sporadic character of the deposits, rendering single holes misleading, and on the high drilling costs, owing to the hard granite to be encountered in deep drilling. Extension of present workings he regards as more economical.

Federated Malay States

▶ Kramat Pulai, Ltd., 2-8 Java St., Kuala Lumpur, F.M.S., operating in the Federated Malay States, is paying out of last year's profits, including the interim, a record dividend of 125 per cent. Total payments over the past four years are brought up to 433¾ per cent. Its big profits in recent years have come from sales of scheelite ore, but its scheelite deposit is rapidly approaching exhaustion, diamond drilling having failed to disclose any worth-while extension. Similarly, it has three years' reserves of tin ore, which exploration indicates is about all there is, unless more is discovered in its Hill lands. Efforts are being made to acquire other tin and scheelite properties, failing which, the management announces, the matter of capital return will be considered.

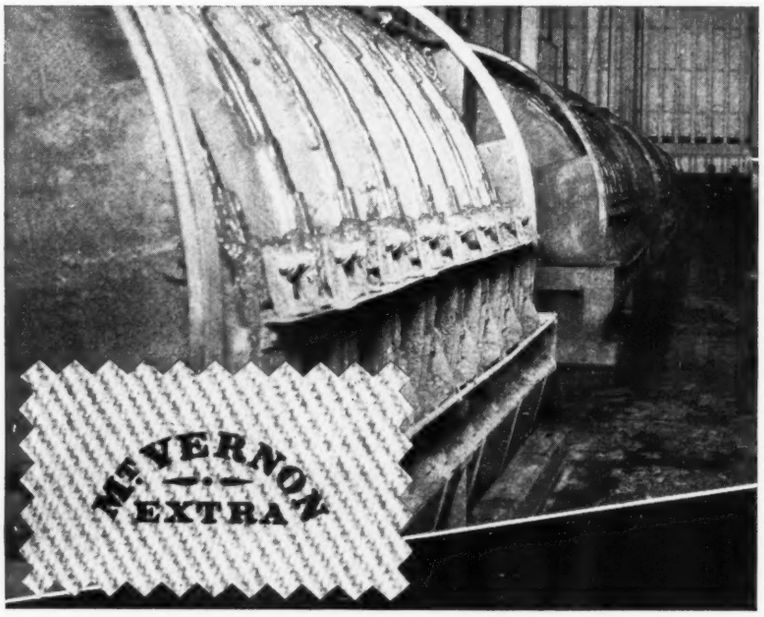
WHAT IS YOUR FILTER FABRIC COST EQUATION...



Only in terms of actual operation can your particular filter fabric cost equation be measured. It involves a great deal more than the original price of filter cloths and the length of time they last. Rate of filtration, pressures, clarity of filtrate, loss or dryness of cake, as well as a number of other factors must all be considered in setting up your particular filter fabric cost equation.

No matter what your operating conditions happen to be, MT. VERNON EXTRA filter fabrics possess these definite advantages. They are woven to rigid standards of tolerance. They are highly uniform and, therefore possess a maximum of effective filtering surfaces.

Specify MT. VERNON EXTRA, the precision filter fabric which will help you keep your filtering costs down to a minimum.



MT. VERNON-WOODBERRY MILLS, INC.

TURNER HALSEY COMPANY

40 WORTH STREET *Selling Agents* **NEW YORK CITY**

Branch Offices: SAN FRANCISCO · NEW ORLEANS · CHICAGO · BOSTON · BALTIMORE

NEW BOOKS

THEORETICAL AND EXPERIMENTAL RESEARCH ON THE PYROMETALLURGY OF ZINC. *Octave Dony-Henault and Claude Decroly. Pp. 269. Georges Thone, Liége.*

THE WORK DISCUSSED in this volume was carried out between 1931 and 1938, financed by the Emile Tassel Foundation. The publication was financed by the University Foundation of Belgium.

The central feature of the work was a critical study of the reaction between ZnO and CO, with and without the presence of solid carbon in various forms. Other tests were made on direct reduction with graphite, anthracite, and oil. Several types of equipment were used to allow for direct and indirect heating by electricity or gas and for varying the method of contact between reducing gas and zinc oxide. This equipment is described and illustrated.

The work of other investigators in this field is discussed, principally from a theoretical standpoint.

All results are compiled and tabulated and should form a valuable reference for those interested in the metallurgy of zinc.

CARLE R. HAYWARD

OFFICIAL MAP PUBLICATIONS. *By Dr. Walter Thiele. American Library Association, Chicago. Pp. 372. Price $4.75.*

THIS VOLUME deals with the evolution of the modern map; with the variety of form and multiplicity of purpose for which it is issued; with the official agencies from which different kinds of maps can be obtained; and finally with schemes for organization and preservation of maps.

Part I is an interesting history of cartography from about 500 B.C. to the present time. But the greatest value of the work to mining men is found in Part II, which is devoted to government maps and mapping services. Described are the various departments, bureaus, and agencies of the United States Government which provide mapping service: (1) the primary agencies such as the Geological Survey, the Coast and Geodetic Survey, the Great Lakes Survey; (2) the secondary agencies including the Bureau of Chemistry and Soils, Forest Service, Bureau of Public Roads, Soil Conservation Service, Federal Power Commission, General Land Office, Office of Indian Affairs, Bureau of Reclamation, Hydrographic Office, War Department; (3) and incidental mapping agencies, the Bureau of Agricultural Economics, Bureau of Air Commerce, Bureau of the Census, National Park Service, Bureau of Aeronautics, Military Intelligence Division, and others. Map publications made available by the bureaus and offices of each government department and each State are listed in detail.

Official map publications of Canada, Great Britain, and Germany are fully outlined; the present status of topographic mapping in Latin America is discussed; and summaries are presented for map publications of Austria, Hungary, Netherlands, and Norway.

In addition there is a brief chapter on general principles of classification, cataloging, and care of maps; tentative map classification outlines by subjects and by areas; list of State, local, and regional map sources; and a list of international maps. The book is fully indexed.

CONCENTRATION DES MINERAIS PAR FLOTATION—EXPOSE THEORIQUE ET PRATIQUE. *Librairie Polytechnique Ch. Beranger, Paris and Liége. 1938.*

THIS BOOK of 460 pages is divided into four principal parts, the first (pp. 9-114) dealing with theory; the second (pp. 115-294), with machinery; the third (pp. 295-425), with practice; and the fourth (pp. 426-457) with economics.

The first part presents flotation theory in a substantially complete manner, with the omission, however, of reference to the new positive-ion agents. Flotation procedures are divided into skin flotation, pressure flotation, film flotation, bulk-oil flotation, froth flotation, chemical flotation, and soap flotation. Such a classification does not seem altogether happy, as it may create in the mind of the reader erroneous distinctions and yet fail to bring out essential relationships.

In the second part, the author treats in detail of mineral-dressing machinery, from pan feeders to filters. It seems that this part might have been condensed to advantage.

The third part is profusely illustrated by descriptions from practice, particularly from American practice, but there are some descriptions of European practice that may be of interest to American engineers. Examples are the operations at Laurium, Greece (p. 321), Trepca, Yugoslavia (p. 330), and Azegour, Morocco (p. 341). This part is divided systematically into treatment of sulphide minerals, oxidized minerals, native metals, non-polar non-metallics, and polar non-metallics.

The author recognizes that most flotation developments have taken place in English-speaking countries and for a foreigner he displays a creditable knowledge of them. But he has not wholly succeeded in passing this acquaintance to his readers: his book is marred by three defects which partake more of the mechanical features of preparing a text rather than of its intellectual features. One defect is the frequent mis-spelling of proper names, *e.g.* "Well, H. Coohill" for "Will H. Coghill" on p. 112; "Rabston" for "Ralston" on p. 459; "Symon's" for "Symons" on p. 133. More serious defects are the lack of an index and the lack of references—a lack which is not made up by the amateurish bibliography at the end of the book.

Many of the drawings are lettered partly in French and partly with borrowed English words (*e.g.* fig. 158-164); this should make the book easier for the average American reader. And many other drawings have been redrawn from obvious American sources.

All in all, this book should prove useful for the French-speaking student of flotation, but it does not add enough to flotation literature in the English language to become widely used in the United States or the British Empire.

A. M. GAUDIN

GOLD AND POVERTY IN SOUTH AFRICA. *By Max Yergan, Director, International Committee on African Affairs, International Labor Relations Institute, The Hague and New York. Pp. 24, Price 15c, plus postage 5c. For ten or more, 10c. each plus postage.*

SOCIAL RESEARCH in South Africa is summarized in this pamphlet in the I.R.I. series dealing with the prevailing social conditions in various parts of the world. It is of particular interest to the mining industry because it deals with the labor problem in the world's foremost gold-producing country. In contrast to the prosperous condition of South Africa as a country, in terms of production of wealth, favorable trade balance, and surplus of government income, there is a marked disparity between these economic factors and the social conditions of nearly 80 per cent of the population. Nearly seven million Africans living in the Union of South Africa are without political or property rights and social opportunities. Their condition is described as one of poverty, without adequate medical attention or housing. Well over 300,000 African natives are employed in the gold mines of South Africa, and are regarded "as part of the natural resources of the country, to be exploited to the fullest possible degree." The author regards these conditions as unhealthy for the Union of South Africa, and feels that "only under conditions of an ever-increasing democracy for all can there be a secure and satisfying life for any."

YEAR BOOK OF THE AMERICAN BUREAU OF METAL STATISTICS. *American Bureau of Metal Statistics, New York. Pp. 120. Price $2.*

THE LATEST VOLUME, the eighteenth annual issue of this publication, covers the record of 1937 on virtually all of the important non-ferrous metals, with special emphasis on copper, lead, and zinc.

pre-coat

a little word with a BIG meaning

It's another effective step toward obtaining more efficient precipitation. Pre-coat is an advanced step in clarification; it removes the harmful colloidal hydrates of aluminum, iron and magnesium. Pre-coat is important in itself; but what is vastly more important—it displays clearly why the Merrill-Crowe Precipitation Process has always maintained leadership in the precipitation of cyanide solutions.

SIMULTANEOUS

PRE-COAT CLARIFICATION

DE-AERATION

PRECIPITATION

THE MERRILL COMPANY *Engineers*

343 Sansome Street, San Francisco, U.S.A.

IN CANADA:
The Merrill Company
302 Bay Street . . . . Toronto

IN AUSTRALIA:
Crossle & Duff Pty. Ltd.
Collins House . . . Melbourne

IN SOUTH AFRICA:
Fraser & Chalmers (S.A.) Ltd.
Cullinan Building, Johannesburg

IN THE PHILIPPINES:
Engineering Equipment & Supply
Co. Inc. . . . Port Area, Manila

MERCO

MERRILL-CROWE PROCESS

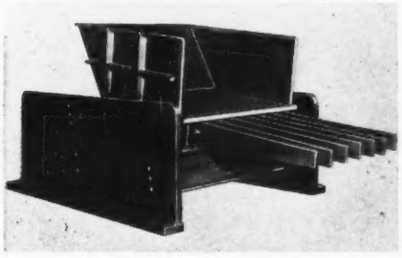
EQUIPMENT NEWS

Electro-Magnetic Vibrating Grizzly Feeders

THE NEW Utah electro-magnetic vibrating grizzly feeder made by Allis-Chalmers, Milwaukee, Wis., is a combination of the company's Utah vibrating feeder and its cantilever grizzly.

The regular cantilever grizzly operates on the principle of particles of ore falling on bars which are supported only at the head end. The impact of the heavy pieces of material causes the free end of the bars to vibrate, thus increasing screening efficiency. The Utah electro-magnetic feeder is a high-frequency, alternating-current vibrating feeder which operates without any motor generator sets, sliding or rotating parts, and is a highly efficient feeding mechanism for both fine and coarse material.

According to the manufacturer, the



combination of the Utah vibrations and the cantilever grizzly principle makes a highly efficient combined feeder and scalping unit for use ahead of crushers to scalp out the fines from the crusher feed, and for use in loading conveyor belts.

Particle Sizer

COLLOID Equipment Company, Inc., 50 Church St., New York City, N. Y., announces the development of a sedimentation method of analyzing particle sizes below 44 microns which affords accuracy of result, speed and ease of manipulation and low first cost. Large samples are said to be unnecessary, accurate results being obtained in about two hours from representative samples of less than 5 grams. This new apparatus, known as the Palo-Travis particle sizer, operates on the principle that dispersed particles of dimensions exceeding the colloidal in a confined fluid medium tend to settle under force of gravity, and the rate of sedimentation proves the means of measuring particle size. It suffices, then, to measure accurately the rate of sedimentation.

An electric stop-clock is supplied on all instruments used on 110 volts, a.c., 60 cycles. Instruments to be operated on other currents are furnished with stop-watch.

Automatic Chain Drifter

THE SULLIVAN Machinery Company, Claremont, N. H., announces its "Adjust-O-Feed" drifter, that is said to be easy to handle, is flexibile, and cost upkeep is low. The main features of the drill

presented by the manufacturer are that it is the only automatic drifter with an adjustable feed for efficient drilling in changeable rock; it uses a chain drive which does away with the expensive feed nut and feed screw replacements; the design of the drive unit with its three major parts is such that more positive feeding is attained. The Sullivan "Adjust-O-Feed" is able, therefore, to drill upholes with ease. An air-operated rotation release is used. This aids materially in collaring holes and in freeing stuck steels.

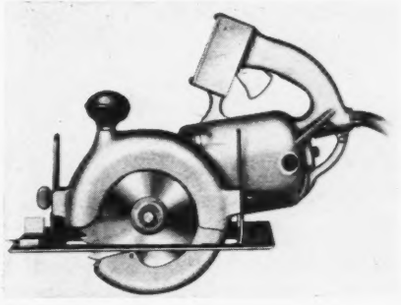
Models J-9 and J-10 weigh 201 lb. and 177½ lb. respectively. J-9 has a 4-in. bore and drill steel change of 30 in. Model J-10 has a 3½-in. bore and a drill change of 24 in.

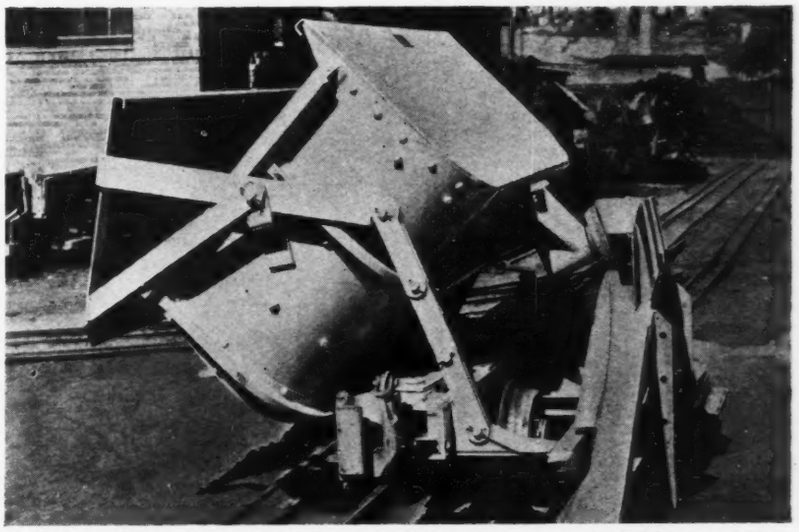
Automatic Shape Machine

COMPRESSED Industrial Gases, Inc., 221 North La Salle St., Chicago, Ill., announce their new CIG Automatic Gas-O-Graph shape-cutting machine, said to cut any type of shape within a range of 30 in. in width and unlimited length. Cuts made by this machine are said to be clean and accurate, so that machining is seldom required. Cutting can be done from a tracing, templet or pattern, and more than one torch can be used when multiple cuts are desired. The unit when assembled weighs approximately 100 lb., is portable and highly flexible in operation, and can be used on 110-volt or 220-volt circuit.

New "High-Torque" 2-in. Electric Saw

A NEW MODEL portable high-torque electric saw of 2-in. cutting capacity has just been added to its line of tools by the Syntron Company, 510 Lexington Ave., Homer City, Penn. The design is



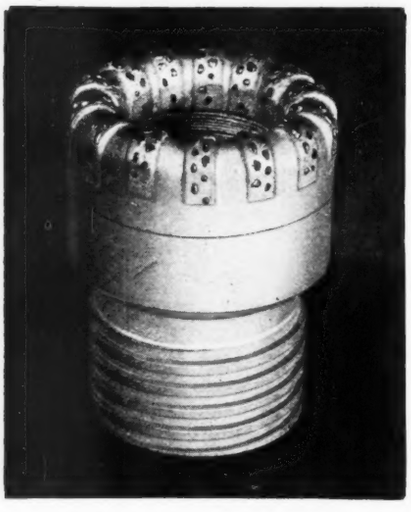


Reduction in the dead weight of heavy mine cars has been effected by the C. S. Card Iron Works, of Denver, Colo., in the construction of a number of these new 2½-ton capacity self-dumping units for a large copper mining company. Weighing 3,858 lb. each, a reduction of approximately 10 per cent, the cars are fabricated entirely of Yoloy, a nickel-copper alloy steel produced by The Youngstown Sheet & Tube Company, and characterized by high tensile strength and resistance to atmospheric corrosion.

said to incorporate all the newest features, including tilting base for bevel cuts; oversize, excess-powered universal motor; double pole; underwriters' approved trigger switch; silent worm-gear drive; and an automatic telescoping safety guard that is said to have the official approval of the most rigid state safety commissions. Its light 18 lb. weight and balanced handle position make it an easy tool for one-hand use. A 6½-in. combination rip and crosscut saw blade is supplied as standard equipment. However, it will also use abrasive disks for slotting brick, tile, etc.

Core Drill Bit

SULLIVAN Machinery Company, Michigan City, Ind., announces a new type of core-drilling bit known as the Koebelite Korbit. In terms of bit cost per foot of hole drilled, savings of 15 to 20 per

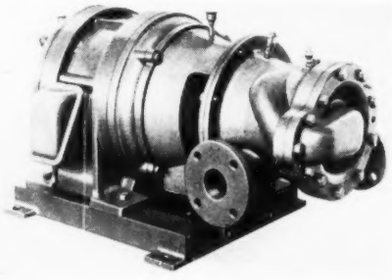


cent are claimed in comparison with any other type of bortz-set, core-drill bit. Faster drilling speed and greater footage per bit are also claimed. Koebelite Korbits consist essentially of a number of bortz-bearing inserts accurately located and firmly brazed into radial slots in the face of the bit blank.

By means of a process developed and patented by C. J. Koebel, of Detroit, Mich., the stone-bearing insert or metal matrix, and the stones, are molded and integrally bonded together, and temperature changes are said not to affect this bond.

Centrifugal Pump

ALLIS-CHALMERS Manufacturing Company, centrifugal pump division, Milwaukee, Wis., has supplemented its complete line of single-stage "SSUnit"

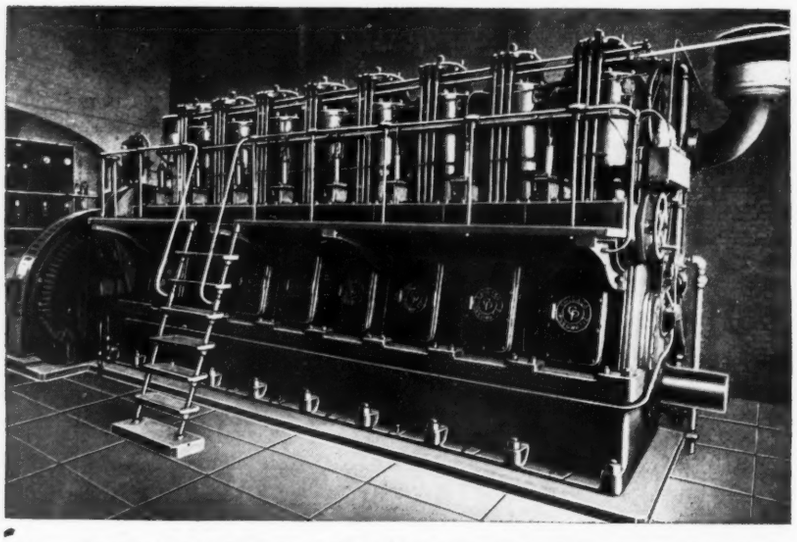


type pumps by adding a 2½x1½-in. two-stage "SSUnit" type pump said to be good for heads up to 525 ft. at 3,550 revolutions. This pump is reported to have an efficient capacity range of from 50 to 100 g.p.m. against heads of from 300 to 500 ft. It is bolted to the motor frame by a splash-proof connection piece, the impellers being mounted on the special motor shaft extension, and the motor bearings also being the pump bearings as in the company's usual "SSUnit" construction.

Convertible Shovel

LIMA Locomotive Works, Inc., Shovel and Crane Division, Lima, Ohio, announces a new convertible shovel, dragline, crane and pull-shovel known as

the Paymaster. The machine is a ¾-yd. shovel weighing 35,500 lb. When equipped as a clamshell or dragline, capacity depends upon length of boom and material to be handled. When equipped as a crane, it has an 11-ton capacity. It is said to be exceptionally fast, with ample strength to give steady, dependable service in all kinds of work suited to a machine of ¾-yd. capacity. As a shovel it is equipped with an 18-ft. boom and a 15-ft. dipper handle. Standard crane boom is 35 ft. However, inserts can be added to make a 50-ft. boom. Many new features are said to be incorporated in its design.



Chicago Pneumatic Tool Company, 6 East 44th St., New York, N. Y., announces a heavy-duty continuous-service diesel engine in sizes of 300 to 800 hp., having many new and improved operating features. The above illustration shows an eight-cylinder 800-hp. RHB-100 CP diesel incorporating these new designs

INDUSTRIAL NOTES

John A. Roebling's Sons Company announces the establishment of a branch office and warehouse at 855 North Ave. West, Pittsburgh, Pa.

Underwriters' Laboratories, a non-profit organization for the testing of various types of safety equipment, is reported to have investigated Bullard Hard-Boiled and Tuff-Nut hats and caps and officially listed them as "suitable for use in locations where there is hazard of falling objects, electric shock, etc."

The Eimco Corporation, of Salt Lake City, Utah, manufacturers of continuous vacuum filters, Eimco-Finlay loaders, and other mining equipment, announces the establishment of a branch office at 333 North Michigan Ave., Chicago, Ill. F. E. Kurz and Paul Richter, both formerly connected with Oliver United Filters, Inc., are in charge.

Jule H. Coffey was recently made vice-president in charge of sales for the Pamona Pump Company, Pomona, Calif.

W. H. Day, formerly with the Pomona Pump Company, is now general sales manager of Peerless Pump division, Food Machinery Corporation, Los Angeles, Calif.

Nordberg Manufacturing Company, Milwaukee, recently completed arrangements with La Consolidada, S.A., Calzada de la Ronda, Apartado 81, Bis, Mexico City, for the sale and service in Mexico of Symons cone crushers, Symons screen, and Nordberg power tools.

Oliver United Filters, Inc. announce the appointment, effective Aug. 1, of C. W. Crumb, as Central Division sales manager, with headquarters at 221 N. La Salle St., Chicago.

Coulter-Sibbett Steel Company, 240 Eighth St., Oakland, Calif., was recently organized to warehouse and distribute tool steels, alloy steels, and special steels and render a procurement service on bar steel for unusual requirements.

BULLETINS

Duronze Alloys. Bridgeport Brass Co., Bridgeport, Conn. A spiral ring technical handbook covering the physical properties and applications of four high-strength silicon bronzes made by the company. Pp. 80.

Hygrometers. Brown Instrument Co., Philadelphia, Pa. Catalog 6502 describes instruments for recording and controlling humidity. Pp. 27.

Light Pattern Plates. George F. Pettinos, 1206 Locust St., Philadelphia, Pa. Folder describes features of lightweight Sonittep Dow metal pattern plates. Pp. 2.

Earth Moving. Caterpillar Tractor Co., Peoria, Ill. Booklet illustrates and explains moving earth under all types of climatic and soil conditions in all parts of the world. Pp. 15.

Roller Chain Data Book. Link-Belt Company, 307 North Michigan Ave., Chicago, Ill. Book 1757 describes Silverlink roller chain and sprockets for drives and conveyor uses; also has engineering data, and application pictures. Pp. 174.

Vacuum Filters. Oliver United Filters, Inc., 351 California St., San Francisco, Calif. Bulletin 206 illustrates and describes use of the manufacturers' diverse filter equipment in mining, sugar, and other industries. Pp. 13. Recent developments in filtration are described in Bulletin 210. Pp. 4. Bulletin 303 illustrates and explains the company's latest filtration accessories. Pp. 12.

Diaphragm Pumps. Colorado Iron Works, Denver, Colo. Bulletin 34-A illustrates and describes construction features of the company's simplex, duplex, triplex, and quadruplex diaphragm pumps. Pp. 6.

Mechanical Dryer. Colorado Iron Works, Denver, Colo. Catalog No. 32-C illustrates and explains in detail the Lowden patent dryer and its uses in mining and other industries. Pp. 32.

Classifiers. Colorado Iron Works, Denver, Colo. Bulletin 24-H describes and illustrates the manufacturer's simplex and duplex high-weir type and submerged type Akins classifiers. Pp. 30.

Diamond Drill. E. J. Longyear Co., Minneapolis, Minn. Bulletin 55 describes the features of the company's Junior Scout diamond-drill core drill. Pp. 3.

Technical Books. General Catalog No. 6 of the Chemical Publishing Company, New York, listing books of all publishers relating to chemistry, bacteriology, pharmacy, engineering, and other branches of technology. Pp. 150. Price 10c.

Molybdenum in Steel. Climax Molybdenum Co., 500 5th Ave., New York, N. Y. The company's attractive 10x11½-in. loose-leaf ring binder contains complete data on the subject of molybdenum in connection with its use in various steels. There are 13 marginal indexed sections, each describing the characteristics, physical properties, and analysis of types of steel that contain molybdenum, and sections are also devoted to corrosion resistance, nitriding, die steels, high-speed steels, cast steels, and a general index.

Roads, Canals, and Embankments. Caterpillar Tractor Co., Peoria, Ill. A handy book for mine operators confronted with the problems of constructing roads in the desert or bush country. The book is written by F. A. Nikirk, a civil engineer who has had long experience in the design and construction of engineering projects. There are 11 chapters, with many illustrations and cuts. Pp. 182. Price, 50c.

Valves, Fittings, Tools. Walworth Co., 60 East 42 St., New York, N. Y. Catalog No. 89, is a handsome, well-prepared and conveniently indexed book covering the complete line of Walworth valves, fittings, pipe, and tools. It has data of special interest to engineers, contractors, plant superintendents, and purchasing agents. Among sections added in the new catalog are the Marine Section; the Lubricating Plug Valve Section, with particular reference to fluids, gases, and the like with recommendations as to the types of lubricants best suited to them; the Hi-Test Cast-Iron Pipe Section; the Fabricated-Pipe Section, which contains information in laying out piping jobs; the Piping Design and Engineering Data Section that contains charts helpful in figuring sizes and types of piping necessary for particular operating conditions. Copies are available to those who request them on their company letterhead. Pp. 602.

Earth-Moving Equipment. R. G. LeTourneau, Inc., Peoria, Ill. The company has available a comprehensive loose-leaf book of all its bulletins, describing use of its carryall scraper, bulldozers, rooters, angledozers, treedozers, and other types of earth-moving equipment. A feature of the book is a large number of photographs and many data sheets obtained from actual operating conditions in this country and abroad.

Marketing Concentrates. Denver Equipment Co., P. O. Box 5268, Denver, Colo. Bulletin 3713-B contains helpful and important data for metal producers who ship base-metal concentrates. The bulletin contains price schedules for various metals sent to smelters and it describes four possible methods of handling a complex sulphide ore. Freight rates on ore and concentrate are also included. Pp. 11.

Merrill-Crowe Precipitation Process. The Merrill Co., 343 Sansome St., San Francisco, Calif. The company's handsome brochure describes the Merrill-Crowe process and apparatus for the simultaneous "pre-coat" clarification, de-aeration, and precipitation of cyanide solutions containing gold and silver. The bulletin is well illustrated and contains blueprints showing types of installations. Pp. 23.

Low-Cost Roads. Allis-Chalmers Manufacturing Co., Tractor Division, Milwaukee, Wis. Booklet contains data on costs of road building and road maintenance. Pp. 33.

Cables. Triangle Conduit & Cable Co., Horace Harding & Queens Blvd., Elmhurst, New York, N. Y. Circular TRI-1050 describes the manufacturer's Tricord Rubber Armor portable cords and cables. Pp. 3.

Mine Car Wheels. C. S. Card Iron Works Co., Denver, Colo. Folder describes Molychro mine-car wheels. Pp. 4.

AMERICAN ZINC, LEAD & SMELTING *and other model mines* **USE** CONCENCO PRODUCTS

In American Zinc's East St. Louis Smelter, one of the strongest links in the chain of profitable processing units leading from lead-free concentrates to shipping department, is a LEAHY No-Blind 4′ x 6′ double-deck vibrating screen. This modern machine is used in the efficient and economical screening of crushed sinter cake before it can be treated in the distilling room.

This is only one example of the application of Concenco Products —concentrating tables, vibrating screens, classifiers, spray nozzles, etc.,—throughout the metal and non-metallic mining fields. High production and low maintenance records prove the outstanding quality of this equipment *worth much more* than its nominal cost. Put these profit-producers to work for *you! Write Today* for details.

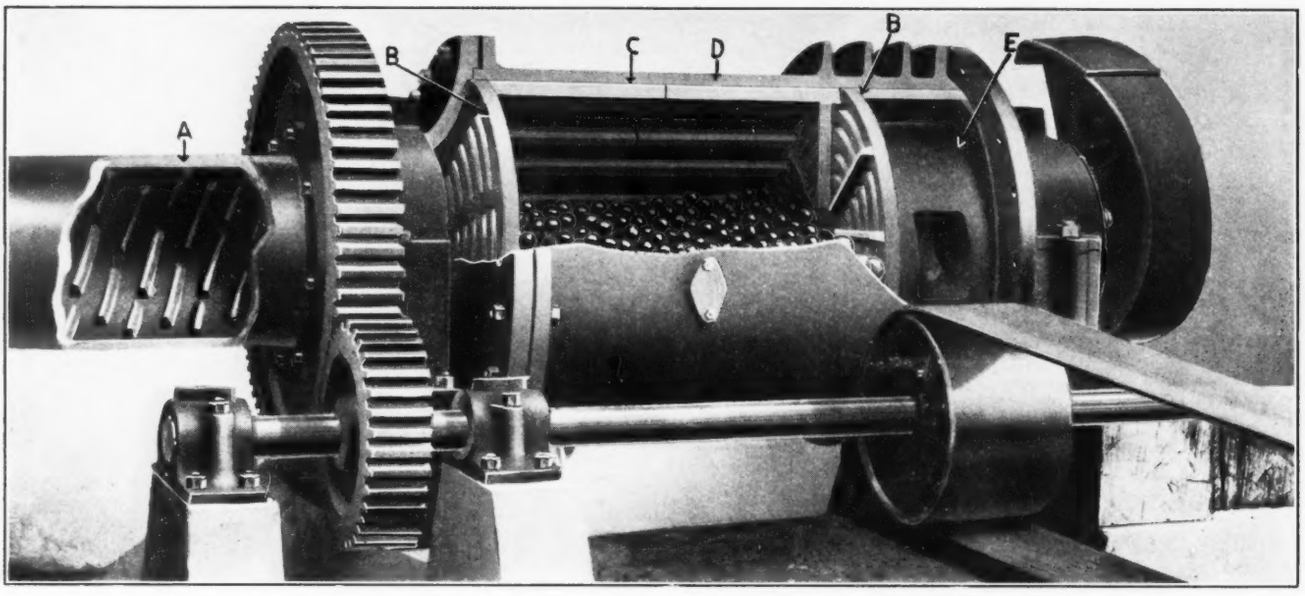
The Original
DEISTER CONCENTRATOR COMPANY
INCORPORATED 1906
903 Glasgow Avenue, Fort Wayne, Ind.
104 PEARL ST., NEW YORK

Write us for complete information on the *New "Type C"* LEAHY

THE Leahy HEAVY DUTY **NO-BLIND VIBRATING SCREEN**

Protected fundamentally by Reissue Patent No. 16,701 Reissued August 9, 1927

PERFECT CLASSIFICATION GUARANTEED WITH GIBSON COMBINATION MILL



● This 3 in 1 unit—the Gibson screenless Combination Elliptic Roll and Ball Mill—crushes and grinds in interconnected grate-separated chambers. The self-contained positive classifier assures uniform product from 10 to 300 mesh absolutely under your control. Proved in service, this single unit saves: (1) in *First Cost*—one unit instead of three or more; (2) in *Space*—eliminates crusher, storage bin, classifier; (3) in *Power*—requires ⅓ less power than ordinary ball mill. Available in 12, 25, 50 and 100 ton capacities. Write for details and comments of satisfied users, also for complete catalog on Gibson mining equipment.

W. W. GIBSON, 1801 WEBSTER ST., ALAMEDA, CAL.

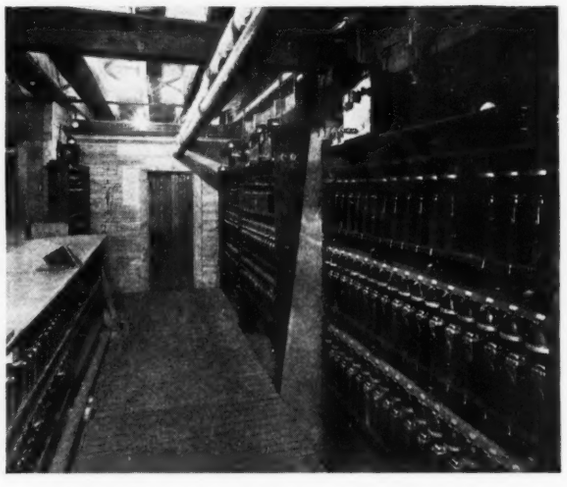
A WHEAT Cap Lamp Installation is FLEXIBLE

The *flexibility* of a WHEAT installation is one of the many advantages offered by this brighter, steadier Electric Cap Lamp.

WHEAT charging equipment is supplied in 50 or 100-lamp independent units. Any number of these units can be installed, and the number of units increased or decreased at will. Surplus equipment can be moved to another location as desired.

Each independent unit—whether a 50 or 100-lamp Charging Rack—has its individual rectifier and current-control unit, the WHEAT Phanacharger.

Another advantage of the flexible WHEAT installation system is the economy it offers by the elimination of costly motor-generator sets, whose capacities are rigidly fixed by their rating.



WHEAT Cap Lamps on charge in a gold mine lamp house

KOEHLER MANUFACTURING COMPANY EMJ 8-38
Marlboro, Mass., U. S. A.
Send full information on WHEAT Electric Cap Lamps, without obligation on my part.
Name ..... Title .....
Company .....
Address .....

For Full Information Fill Out and Mail the Coupon

Eastern & Mid-Western Bituminous Distributors: **PORTABLE LAMP & EQUIPMENT CO., Pittsburgh, Pa.** ***Western Bituminous & Metal Fields*** **(including Western Canada and Mexico): E. D. BULLARD CO., San Francisco, Cal.** ***Eastern Canada:*** **H. C. BURTON & CO., Hamilton, Toronto, Kirkland Lake, Montreal.** ***Great Britain & Abroad:*** **OLDHAM & SON, Ltd., Denton, Manchester, England.**

Aerial Tramways in the Metal-Mining Industry

THIS is the first of two papers dealing with construction and use of aerial tramways in the metal-mining industry. It describes practices and equipment used in tramway construction and discusses the design of tramways. The second paper will describe the construction and operation of tramways and give operating costs.

The author acknowledges the cooperation of a number of cable and tramway manufacturers who supplied practical manufacturing data and other valuable information. Full credit for formulas used in the design of aerial tramways is given to Edward B. Durham[1] and F. C. Carstarphen.[2]

History

The early history of aerial tramways is obscure, but apparently the first important installation was made in Germany in 1860. This was a tramway of the continuous monocable type and was followed later on by one of the continuous bicable type. Early systems of various types were developed in Germany and England and were introduced in America in 1887.[3]

Without doubt, the early systems were limited in capacity and efficiency and probably were used only in places to which they were peculiarly adapted. With improvement in metallurgical, construction, and engineering practices, their capacity, efficiency, and usefulness have been greatly extended, until today aerial trams are found in many industries, competing successfully with other modes of transportation.

Types of Tramways—The two types of tramways most generally used are the double-rope continuous tramway and the jig-back or reversible tramway. The double-rope tramway consists of two stationary or track cables and an endless traction cable, with a number of carriers attached at more or less equal intervals by means of grips. The traction rope runs around sheaves at the terminals and is generally operated by a motor and controlled by suitable braking equipment. Usually, the carriers are detached at the terminals for loading and unloading and reattached for dispatching. When loads are transported downhill the motor acts as a brake or control while the tram is operating, and in many instances power is generated and put back into the line.

The jig-back tram may be of the single reversible type or the double reversible type. In the single reversible type there is one track cable on which a single carrier is operated by a traction cable attached to a hoist or sheave and operated by a motor. The motor operates in one direction to transport the load from the loading terminal to the discharge terminal and is reversed to bring the empty carrier back to the loading terminal. The double reversible tramway operates the same as the single reversible tramway, except that there are two track cables with a carrier on each. It is generally operated by a single traction cable running around a sheave and with a carrier attached to each end.

Jig-backs of 150 tons' per hour capacity are in use, but generally their capacity is less than this. Due to the reversing feature of their operation, they are generally more limited in capacity than are tramways of the double-rope continuous type. They can be operated at much higher speed than other types of tramways, and this compensates in part for their limitations in other respects. To work successfully, they should be built with the track cables at a fairly uniform inclination, which tends to limit their length. A double reversible jig-back requires about the same amount of cable as a double-rope continuous tramway, and because of this the difference in their costs may be negligible.

Distance is a limiting factor in the capacity of tramways of this type. This is because the number of carriers is limited to two. The relation of distance to capacity of a jig-back tram is similar to the relation of depth of a shaft to the hoisting capacity of a mine hoist.

A third type of tramway used occasionally is the monocable continuous tram. This consists of a single endless cable running around sheaves and with carriers spaced at about equal distances. The cable performs the double duty of supporting and propelling the loads. In some systems the carriers are detachable; in others they are fixed to the cable. When they are fixed, loading and unloading must be done while they are in motion. Detachable carriers are equipped with rollers so that they can be run on a rail at the terminals. The towers are equipped with rollers designed so that the carriers will pass over them.

Tramways of this type are rather common in England and Europe, but are less common in North America, except where they are used for light duty, such as carrying fruit and other light material. Systems up to 30,000 ft. in length are in successful use. Some American manufacturers have discontinued building them, whereas others who still build them maintain that they are satisfactory for long distances and large capacities.

A successful tram of this type is used by the Hollinger Gold Mining Company, Ontario, Canada,[4] for hauling and distributing sand and gravel for back filling in the mines. This tram, which was built by an English manufacturer, is 3.6 miles long and the difference in elevation between the loading and discharge terminals is only 100 ft. The rope speed is 527 ft. per min., and the capacity of the carriers is 1,900 lb., the hourly capacity of the tram being 190 tons. The cable is $1\frac{5}{16}$ in. in diameter and is operated at a tension of 26,000 lb. Several cables have been worn out since the tram was installed. The last cable was still in use after having transported over $1\frac{1}{2}$ million tons of sand. The costs are about 6c. per ton, including tram operation, maintenance and replacement of cable, cost of unloading the buckets, and maintenance of distributing equipment, towers, etc.

This tram was built in a country where the topography is favorable. The terrain is comparatively level, which makes it possible to space the towers closely and hence operate the cable at a comparatively low tension for a tram of its capacity. Furthermore, the difference in elevation between the highest and lowest point—in this case, the terminals—is not enough to cause any serious increase in tension at the upper terminal. In

---

[1] Durham, Edward B.: "Aerial Tramways and Cableways." Mining Engineers' Handbook, by Peele, 2d ed., 1927, Vol. 2, Sec. 26, p. 1745.

[2] Carstarphen, F. C.: "A Simple Method of Computing Deflections of a Cable Span Carrying Multiple Loads Evenly Spaced." Colorado School of Mines Magazine, Vol. 19, No. 12, December, 1929, p. 15.

[3] American Steel & Wire Company catalog for 1935.

[4] Williams, Maurice E.: "Procurement, Transportation, and Distribution of Backfill at the Hollinger Mine." Canadian Min. Jour., Vol. 56, No. 9, September, 1935, pp. 418–421.

rough country, where difficult profiles cannot be avoided and consequently close spacing of towers is impossible, the cable tension for a tram of 190 tons per hour capacity would have to be 30,000 lb. or more at the lowest point. If the difference in elevation between the highest and lowest point were 1,500 ft., which is not unusual, the tension at the highest point would be increased by 28,000 lb., due to the weight of the loads and the cable, making a total of 58,000 lb. This would indicate that monocable systems should be avoided in rough, steep countries because of the impossibility of avoiding excessive tension in the running cable.

Of the three types of tramways mentioned, the double-rope continuous type is the one most commonly used in the metal-mining industry. It is also the most flexible and lends itself more readily to varying topography, long distances, and large capacities than does any other type. The remainder of this paper will be devoted to a discussion of tramways of this type. Formulas used for cable deflections are applicable to tramways of any type. In general, the structures for supporting the cables are essentially the same for all types, except that rail structures, tension stations, and anchor stations would seldom, if ever, be used on tramways of the jig-back type or the monocable continuous type.

Automatically Operated Tramways—With the automatically operated tramway, a tripping device discharges the load while it is in motion, and the carrier remains gripped to the traction cable as it passes around a sheave designed for that purpose. Loading is done from chutes that have mechanically operated gates. The carriers generally are ungripped for loading, but systems are in use whereby the loading is done from a hopper that moves on overhead rails along with the carrier until the load is delivered to the carrier. In this way, loading is done without ungripping the buckets from the traction cable. There is no particular advantage in this method of loading, and it tends to complicate the system by adding more moving parts than would otherwise be necessary. Most of the heavy-duty systems used in the coal-mining industry are unloaded automatically, but they are loaded from a stationary chute while the bucket is ungripped.

Generally, only one man is required to operate tramways of this kind. The operator is stationed in the loading terminal; he starts and stops the tram and works the levers that control the mechanically operated gates. Gripping and ungripping are done automatically and the loads are dispatched by an automatic timing device.

The carriers of an automatically operated tramway can be made to discharge their load at any point along the line. This is taken advantage of in the coal-mining industry, where they are used for mine-waste disposal. Other conditions permitting, there is no reason why a tram of this kind could not be used for transporting mill tailings from the mill and discharging them at points along the line and at the same time transport ore from the mine to the mill.

At metal-mining plants, where trams are used for transporting timber, rails and other supplies to the mine as well as for transporting ore and supplies from the mine, an automatically operated tram would have no advantage over a hand-operated system.

General Considerations

Applications and Limitations—For transportation over distances up to 25 miles in regions where the topography is extremely rough, or down precipitous slopes, aerial tramways have a great advantage over most other methods of transportation. Their operation is practically unaffected by snow or other weather conditions. Construction costs may vary greatly with topography, but operating costs are affected very little. Mountain ranges are crossed and ravines and streams are spanned without expensive grading or other preliminary work.

Aerial trams have been adopted at many mines as the only practical means of transportation. In the high altitudes of Colorado and Utah, many mines are practically inaccessible during the winter months except by means of aerial trams. At these mines the trams are used for passenger service as well as for transporting all kinds of material to and from the mines. On the other hand, due to their efficiency and dependability, they are used in a great many places where other methods of transportation are feasible.

The capacity of a tramway may range from 25 to 300 tons per hour, but in the metal-mining industry their use has been limited largely to plants of less than 1,000 tons' daily capacity. However, aerial trams could be used at metal-mining plants having capacities greatly in excess of this. They are used in the coal-mining industry for transporting coal and mine waste at a cost as low as 1c. per ton-mile. The construction industry utilizes them for transporting sand and gravel. In the past ten years they have been used on many large construction projects in every part of the country as the most economical and dependable means of transportation, regardless of the temporary nature of the work.

Because of their great dependability, it has been possible to operate tramways continuously and to transport as much as 6,000 tons of material every 24 hours. Tramways having greater capacities than this are in use now, and still greater capacities are planned.

The feasibility of underground loading terminals has been proved and underground construction practices have been sufficiently worked out to permit the operation of carriers and traction cable in adits or tunnels of any length. Such arrangements make possible the transfer of ore from ore passes and underground bins directly to tramway carriers, thus eliminating underground motor haulage and extra handling of ore at the portal of the haulage tunnel.

The tramway of the San Francisco Del Oro mines, near Parral, Mexico, is an outstanding example of the application of aerial tramways to underground haulage problems. This tramway, described in the *Engineering and Mining Journal* of August, 1936, runs underground in an adit for 3,000 ft.

A tramway 54 miles long is in operation in Colombia, South America, and projects are under way for still longer ones. Long tramways are built in sections, each operated by an independent traction cable passing around sheaves at the ends of each section. The carriers are automatically detached from the traction cable of one section and automatically attached to the traction cable of the next. The length of a section depends on the difference in elevation of the highest and lowest point and also on the friction necessary to be overcome by the traction cable. Track cables between sections are either continuous or connected by means of rail structures, and the carriers pass from one section to the other without interruption.

Angle stations sometimes are found to be of great advantage in countries having extremely rough topography. Instead of a straight line between terminals, an angle station permits one or more horizontal angles in the alignment, and hence makes possible a choice of more suitable topography than would otherwise be possible. An angle station may be the ends of two sections, each operated by an independent traction cable, or the traction cable may pass through the angle station to the other part of the tram, making a continuous system. In the former case the carriers would have to be detached and attached, as in a long tramway built in sections. In the latter, the carriers remain gripped as the traction cable passes around sheaves that are designed for that special purpose.

(*To be continued*)

Excerpted from U. S. Bureau of Mines Information Circular 6948, entitled "Aerial Tramways in the Metal-Mining Industry," by O. H. Metzger.